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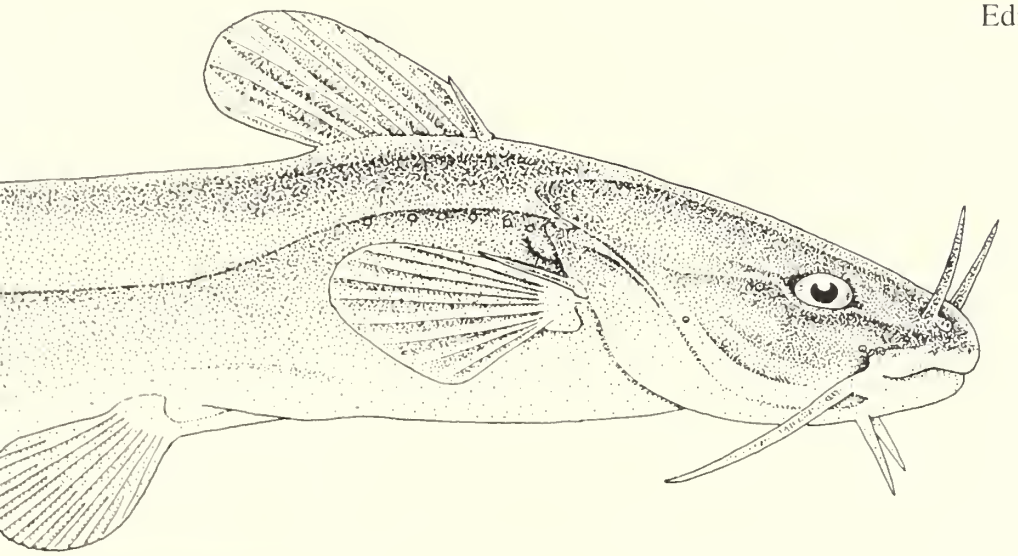
ENDANGERED, THREATENED, AND RARE FAUNA OF NORTH CAROLINA

Part IV. A Reevaluation of the Freshwater Fishes

Edited by EDWARD F. MENHINICK
and ALVIN L. BRASWELL



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Endangered, Threatend, and Rare Fauna of North Carolina

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Edited by
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Endangered, Threatened, and Rare Fauna of North Carolina
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Table of Contents

How To Use This Document

This document is published by the North Carolina State Museum of Natural Sciences as a service to academic, private, and governmental agencies engaged in conservation-based activities. Although the information contained within will be of value to ichthyologists and natural historians involved in diverse pursuits, we anticipate that it will also serve the systematic/taxonomic layperson and public works project manager.

- To find a fish by either vernacular or scientific name, consult the index. All fish are listed alphabetically by genus and species (common practice); by species name first, followed by the genus (genera) in which that name occurs (useful if you are not sure of the genus name or its correct spelling); and by common name.

- Because common names may vary from person to person and among geographic regions, we have standardized the common names used in this document to those recommended by the American Fisheries Society (*Common and Scientific Names of Fishes from the United States and Canada*, Special Publication 20 [1991]). Common names are indexed in two ways:
  a. by general classification; the Roanoke Bass will be found under "Bass, Roanoke," along with any other fish whose common name contains the word "Bass";
  b. by modifier; the Roanoke Bass will also be found under "Roanoke Bass."

- If you know the fish's federal or state legal classification, the Table of Contents will provide the quickest gateway to the information available on this species.

To further facilitate accurate and timely retrieval of information, we provide:

- a North Carolina map showing counties and physiographic provinces (see Appendix A);
- a North Carolina map showing major drainage systems (see Appendix A);
- a listing of protected species arranged by drainage systems (see Appendix B, Table 3);
- a listing of protected species and the North Carolina counties they inhabit (see Appendix C);
- and a listing of North Carolina counties and the protected species they contain (see Appendix D).

We hope that the cross-references serve to provide fingertip access to any interested party, regardless of his/her level of familiarity with fishes.

Stephen D. Busack, Ph.D.
Director of Research and Collections
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Endangered, Threatened, and Rare Fauna of North Carolina

Part IV. A Reevaluation of the Freshwater Fishes

The conservation community has long recognized the need to monitor wild populations of plants and animals so that appropriate laws and management practices can be instituted to help prevent the loss of natural diversity. An integral step in this process is informing academic, governmental, and private sectors of the problems confronting a given species or population and the reasons for those problems, suggesting possible solutions to the problems, and identifying areas where additional study may be needed. In 1975 the N.C. State Museum of Natural Sciences sponsored a symposium on the endangered and threatened plants and animals of North Carolina (Cooper et al. 1977); a decade later the museum initiated a reevaluation of the faunal portion of the 1975 proceedings. Reports from the 1985 symposium concerning mammals (Clark 1987), marine and estuarine fishes (Ross et al. 1988), and birds (Lee and Parnell 1990) have previously been published, and this report is the fourth in the series reporting findings from that symposium. Because it has been quite some time since the second symposium was held, each species account author has been provided an opportunity to update his account; the data contained in this document are considered current as of January, 1997. Information concerning the objectives of the 1985 symposium and a discussion of the legal aspects of rare and endangered species protection at the state and federal levels is provided by Clark (1987).

Status Definitions

Confusion between legal status and biological status has prompted modification of the conservation status categories used in Cooper et al. (1977). Following is a summary of the categories that currently afford legal protection to animal species under U.S. federal or N.C. state wildlife statutes.

Federally Endangered refers to species listed as Endangered by the U.S. Fish and Wildlife Service under provisions of the U.S. Endangered Species Act of 1973 as amended; it includes any species whose continued existence is in jeopardy throughout its range.

Federally Threatened refers to species listed as Threatened by the U.S. Fish and Wildlife Service under provisions of the U.S. Endangered Species Act of 1973 as amended; it includes any species that is likely to become a U.S. Endangered species within the foreseeable future.

State Endangered refers to species listed as Endangered by the N.C. Wildlife Resources Commission under provisions of the state's nongame endangered wildlife law of 1987; it includes any native species whose continued existence as a viable component of the state's fauna is determined to be in jeopardy. Species residing within the state that are assigned U.S. Endangered species status automatically assume State Endangered species status.

State Threatened refers to species listed as Threatened by the N.C. Wildlife Resources Commission under provisions of the state's nongame endangered wildlife law of 1987; it includes any native species that is likely to become a State Endangered species within the foreseeable future throughout all or a significant portion of its range within the state. Species residing within the state that are assigned U.S. Threatened species status automatically assume State Threatened species status.

State Special Concern, a category that has no U.S. federal counterpart, refers to native species having a level of threat to their existence that is legally recognized as being significant under provisions of the state's nongame endangered wildlife law of 1987. This category applies to species that are likely to become threatened, and to species known or thought to be extirpated from the state.

Because some fish species are currently recognized by field biologists as potential candidates for legal status, or are regulated as sport or game animals, we include survival status information for these species in a section we have labeled "Other Species of Interest." This category has no U.S. federal or state legal standing, but our concern for the continued survival of these fish species in North Carolina dictates our including these data in this publication.

Discussion and Summary of Recommendations

As part of the 1985 reevaluation process, members of the original Freshwater Fishes Committee reviewed fish species thought to have significant population problems, including all species listed in Cooper et al. (1977:265–298). This committee's recommendations were adopted in their entirety by the N.C. Wildlife Resources Commission and incorporated into the North Carolina Administrative Code effective 1 November 1991. Table 1 presents a comparison of state conservation status for North Carolina freshwater fishes in 1977 and 1991 (see Appendix B). Status assignments in 1977 did not utilize State Endangered and State Threatened legal categories because the state's nongame endangered wildlife law had not yet been enacted. Species considered endangered, threatened, or rare within the state were assigned Special Concern status, a nonlegal, biological status. Table 2 summarizes changes in information since the 1991 report was submitted to the N.C. Wildlife Resources Commission, including revised nomenclature, additional species accounts, one replaced species account, and recommended changes in status (see Appendix B). Individual accounts detail the rationale for the levels of protection assigned

to the species and include recommendations for managing, monitoring, regulating, and periodically reevaluating listed species. Table 3 provides a listing of all protected species and their distributions within the major drainage systems of North Carolina (see Appendix B).

Native populations of the Roanoke Bass have problems associated with hybridization, whereas the Longear Sunfish represents a species with a very limited range in North Carolina. Detailed accounts of these species are included for informational purposes in the section labeled "Other Species of Interest." The committee also recognized a group of species that has been shown to be more abundant or widespread than previously believed and/or are no longer subject to any definable threat; should further research or changes in land use indicate significant decline in any of these species, they will need to be reevaluated for conservation status. Species having marginal status should also be periodically monitored. Brief accounts of species falling into these categories are also included in this section to bring their attention to the biological community.

The Freshwater Fishes Committee encourages continued research on rare, endangered, and threatened freshwater fishes, with particular emphasis to be placed on those species requiring habitats that are in danger of impoundment or other permanent modification. Species given protection under the nongame law should be reexamined periodically, preferably every three years, so that new information can be incorporated into their status evaluations. Biologists are encouraged to include in their research initiatives those species identified as an "other species of interest" so that appropriate information becomes available for making informed decisions about the need for legal protection. The official conservation status of any species may change over time; if in doubt regarding current legal status, contact the N.C. Wildlife Resources Commission.

Plans for the introduction of sport fish should require the review of potential impact on native populations of nongame species, as well as an assessment of the effect on the genetic integrity of that particular game species. Native populations of Roanoke Bass should receive some protection to prevent pollution of the remaining original genetic stock. Introductions of alien species should be closely regulated to prevent harm to vulnerable native populations through competition or predation. Miller et al. (1989) state that the effects of alien species are the second most-common cause contributing to the extinction of North American freshwater fishes.

Williams et al. (1989) point out that there is a continuing decay of aquatic habitats in North America as reflected by a decline in fish populations and the lack of successful recovery efforts because of problems with destruction, modification, or curtailment of range or habitat. None of the North American fish species they listed with Endangered, Threatened, or Special Concern status have significant problems as a result of overuse for recreational, scientific, or educational purposes. They give two recommendations for future conservation efforts: devote conservation efforts to entire ecosystems rather than to individual species, and establish long-term monitoring programs to gather accurate baseline status information on fish populations and aquatic habitats.

Protection of natural diversity in our aquatic ecosystems should be given a high priority. North Carolina's freshwater fishes are potentially one of our most important allies in the task of environmental monitoring of major aquatic ecosystems. The continued welfare of the state's rivers, streams, and lakes is essential to the health of its citizenry and its economy. When used properly, aquatic indicator organisms can provide forewarning of many developing environmental problems. Intact and diverse natural communities are useful as biomonitoring tools because they provide baseline information and can be used to study biotic interactions in the absence of perturbations. Disturbed communities, while providing much needed data, cannot tell us what was present before environmental changes took place. It is hoped that the information presented in this publication will be useful to individuals whose tasks include the monitoring and/or management of the state's aquatic ecosystems.

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Federally Endangered Freshwater Fishes of North Carolina

Shortnose Sturgeon

***Acipenser brevirostrum* Lesueur**

Status: Federally Endangered.

Description. The Shortnose Sturgeon is easily confused with young Atlantic Sturgeon, *A. oxyrhynchus*, from which it differs by having a wider mouth (mouth width greater than 62% interorbital width), a shorter snout, usually no plates between the anal fin base and the lateral scute row, and a smaller size (seldom exceeding 1,000 mm TL). It has a heterocercal tail; an inferior, protrusible mouth preceded by four barbels the length of which are less than half the width of the mouth; and a body covered with five rows of bony scutes. Body color is yellowish brown with a darker, blackish head and back. Ventrally, the fish is pale, white to yellowish. Young have melanistic blotches; the viscera are blackish (Dadswell et al. 1984).

Range. The Shortnose Sturgeon ranges from the Saint John River, New Brunswick, Canada, to the Indian River, Florida. In North Carolina before 1985 there were plausible records only from the Beaufort area, Neuse River, and Salmon Creek of the lower Chowan River. Salmon Creek is the only historical record (April 1881) confirmed by a museum specimen (Ross 1988). In February 1985 a gravid female Shortnose Sturgeon was taken from the Pee Dee River below Blewett Falls Dam, but this fish's affinity was with the South Carolina Pee Dee River population. Shortnose Sturgeon are currently only known from the Cape Fear drainage in North Carolina. Since discovered there in 1987 (Ross 1988), nine adults have been captured in the lower Cape Fear River and its tributaries, the Brunswick River and mouth of the Black River (Ross 1988; Moser and Ross 1989, 1993, 1995). Ultrasonic tracking, gill net surveys, and surveys of fishermen indicate that this species occurs frequently and uses a large part of the drainage between Wilmington (river km 45) and Lock and Dam No. 1 (river km 96); but the population is small, and its reproductive status is unknown (Moser and Ross 1993). Shortnose Sturgeon reproductive migrations are likely blocked by the Lock and Dam (Moser and Ross 1993, 1995), and the population is also vulnerable to water quality and habitat degradation and fishing mortality (as by-catch in the shad and Striped Bass gill-net fisheries).

Habitat. The Shortnose Sturgeon is probably restricted to rivers and estuaries; it is a benthic, anadromous species but one with some land-locked populations. This fish seems to prefer deep areas with soft substrate and vegetated bottoms. It may move from shallow to deep waters during winter and may exhibit diurnal movements. For spawning it requires freshwater swamps or areas with fast flow and rough bottoms (Dadswell et al. 1984). Southern spawning sites may be characterized by submerged timber and mixtures of sand, clay, and gravel in depths between 6 to 9 m (Hall et al. 1991).

Life History and Ecology. The following account pertains to South Carolina and Georgia populations and is from Dadswell et al. (1984). Spawning takes place from January to April. Females probably spawn once every 3 years at maximum, but males may spawn more frequently. Each female may deposit 27,000 to 208,000 adhesive eggs. Juveniles may remain upriver for several years. By the time the fish are 2 to 4 years old they are about 500 mm long. Males reach maturity when 3 to 5 years old and females when 6 to 7 years old. Longevity is probably less than 30 years, and the species seldom grows larger than 1,000 mm. Shortnose Sturgeon eat benthic polychaetes, crustaceans, insects, and small mollusks; they also ingest quantities of sediment, detritus, and surface-floating vegetation. They may feed largely at night.

Special Significance or Unique Characteristics. Because healthy populations tend to be relatively few and scattered, protection is critical to the overall survival of this species.

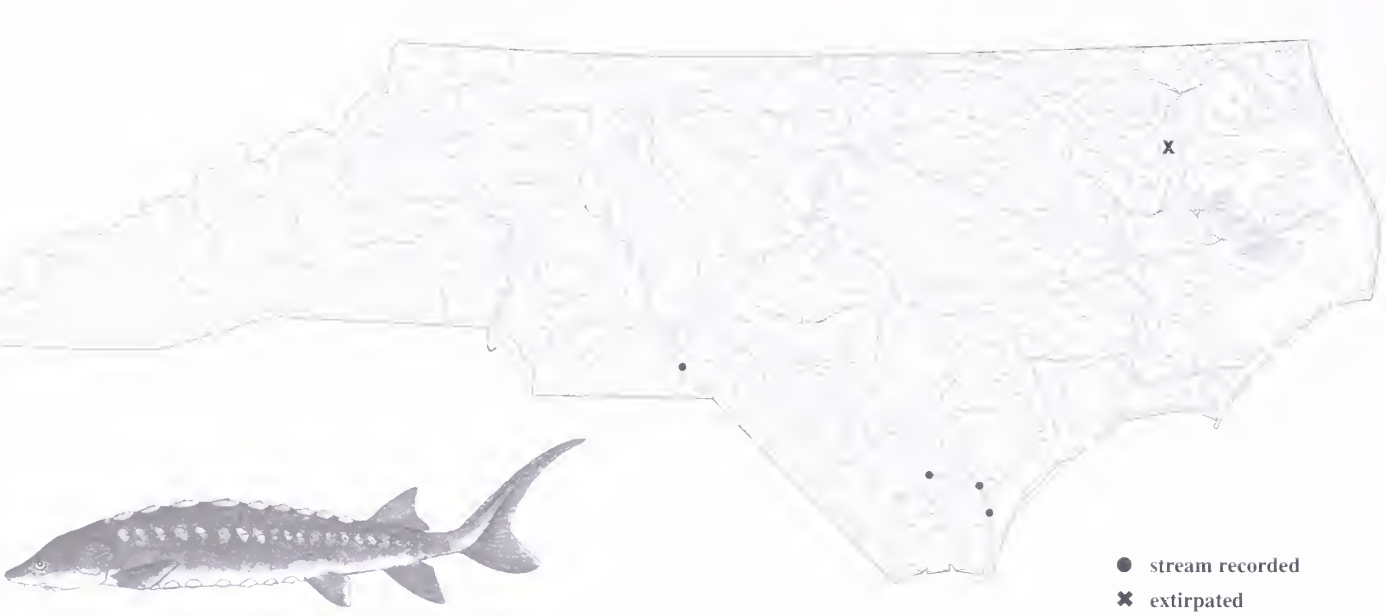
Rationale for Evaluation. Both range and population size have declined through the twentieth century, primarily because upriver areas necessary for spawning and nurseries have been increasingly modified or destroyed. Late maturation, periodic spawning, and slow growth make Shortnose Sturgeon unusually vulnerable to anthropogenic disturbance.

Current Protection. The Shortnose Sturgeon is currently protected under the Endangered Species Act of 1973 as amended. Since 1 September 1991 it has been illegal to possess any species of sturgeon in North Carolina.

Recommendations. Surveys of the Cape Fear River system should be continued to determine habitats, reproductive use, and population structure of the Shortnose Sturgeon. Effects of locks and dams on sturgeon migrations need to be studied, and other North Carolina rivers (especially the Roanoke and Chowan Rivers) need to be examined for populations of this species. Genetic studies are needed along the U.S. East Coast to determine the degree of gene flow and population isolation.

Shortnose Sturgeon

***Acipenser brevirostrum* Lesueur**



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Prepared by Steve W. Ross

Cape Fear Shiner

***Notropis mekistocholas* Snelson**

Description. The Cape Fear Shiner is a straw-colored to yellowish minnow, 45 to 65 mm SL, with clear fins and a narrow, black lateral stripe extending from the snout to a black wedge spot on the caudal peduncle (Snelson 1971). A long, transversely looped intestine and black peritoneum distinguish it from all other N.C. shiners. Externally, it may be confused with the sympatric species *N. procne, N. alborus, N. hudsonius,* and *N. petersoni,* but the Cape Fear Shiner is distinguished by a combination of 8 anal rays, a small, nearly horizontal mouth, black tips on the upper and lower lips, 11 to 13 predorsal circumferential scales, dorsal fin insertion directly above or anterior to pelvic fin insertion, and eye midway between the dorsal and ventral profiles of head (Snelson 1971, Menhinick 1991).

Range. This species is endemic to the Cape Fear River basin, North Carolina, in Randolph, Moore, Chatham, Lee, and Harnett Counties. Since its discovery in 1962, specimens have been taken from the Haw River and Robeson Creek near Pittsboro, the Rocky River and Bear Creek below Siler City, the Deep River between Coleridge and Carbonton, the Deep River below its confluence with the Rocky River, and the Cape Fear River (including its tributaries Parkers Creek and Neills Creek) between Buckhorn Dam and Lillington (Snelson 1971; Pottern and Huish 1985, 1986; J. Alderman, pers. comm.).

Habitat. The Cape Fear Shiner prefers wide, shallow, rocky segments of medium-size to large streams with forested banks, alternating riffles and pools, and abundant growths of *Justicia, Podostemum,* and filamentous algae (Snelson 1971). The substratum is usually a mixture of sand, gravel, rubble, and boulders, with little silt. During high river flows and cold weather, they frequent mouths of tributaries, pools beside undercut banks, and secondary flood channels, in slower but not still water. Young-of-year were collected in slow-moving, vegetated shallows among midchannel rocky islands in the Deep River (Pottern and Huish 1985).

Life History and Ecology. Spawning has not been observed. Snelson (1978) suggests a late spring to early summer spawning season. Pottern and Huish (1985) observed males with intensified yellow coloration and apparently gravid females during May through July and collected young-of-year (15 to 25 mm SL) from September through November. Age at maturity, fecundity, and longevity are unknown. It is usually collected in large, mixed schools with *Notropis scepticus, N. procne, N. amoenus, N. altipinnis, Luxilus albeolus,* and *Cyprinella analostana.* The intestinal morphology suggests a more herbivorous or detritivorous diet than other *Notropis* species, but arthropods are readily consumed (Snelson 1978, Pottern and Huish 1985).

Special Significance or Unique Characteristics. This species and *N. mbilus* of the Mississippi River basin are the only two members of the genus with a convoluted intestine and black peritoneum. They may be more closely related to the genus *Dionda* of the Rio Grande basin than to other *Notropis* species. The Cape Fear Shiner may therefore be important in reconstructing the evolutionary history and biogeography of this group of minnows. Its herbivorous specialization among an assemblage of otherwise carnivorous minnows makes it of interest to physiological and community ecologists. Also, it has the smallest known natural range of any *Notropis* species.

Status. Federally Endangered.

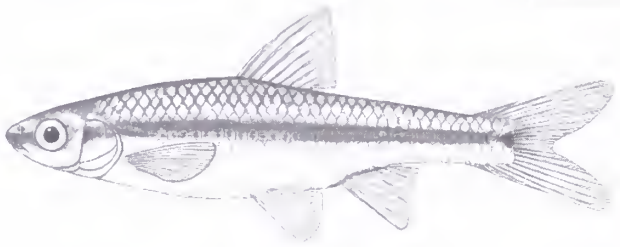
Rationale for Evaluation. Collections during the past decade (Pottern and Huish 1985, 1986; J. Alderman, pers. comm.) indicate that the only large extant population occurs near the confluence of the Deep and Rocky Rivers. Extensive riffle and pool habitat in the Haw River was destroyed when B. Everett Jordan Reservoir was impounded in 1981. Small populations persist in the Deep River between Coleridge and Carbonton and in the Haw River above Jordan Reservoir. Populations in Robeson Creek, the Rocky River above Bear Creek, and the Cape Fear River and its tributaries near Lillington are apparently extirpated or nearly so. The Deep River and Rocky River are subject to numerous point-source discharges, urban and agricultural runoff, and flow diversions that may degrade habitat.

Current Protection. The Cape Fear Shiner is currently protected under the Endangered Species Act of 1973 as amended. Federally designated Critical Habitat includes two segments of the Rocky River (interrupted by a small hydroelectric impoundment) and a segment of the Deep River between Coleridge and Highfalls. The Haw River and Cape Fear River locations are not designated Critical Habitat. The species may now be extirpated from the upper Rocky River segment.

Recommendations. Habitat degradation from impoundment, flow regulation, wastewater discharge, and urban and agricultural runoff appear to be major threats to this species. Research is needed on life history, physiological tolerance, and ecological requirements. Wastewater discharge permit renewal requests in the Rocky and Deep River basins should be considered in light of the needs of this fish. Minimum release flows should be assigned to any impoundments having the potential to reduce flows below seasonally determined crucial levels. Controlled multiple-depth withdrawal structures may be useful if tailwater quality is determined to be a problem. New discharges, withdrawals, and impoundments on these streams should be discouraged if feasible alternatives exist, and habitat protection and compensatory mitigation should be high priorities when permitting projects for which there are no feasible alternatives. Urban and agricultural stormwater runoff controls, including wide forested buffers, should be encouraged on new development projects and major existing sources in the basin. A captive propagation and stocking program may be helpful if suitable streams are located elsewhere in the Cape Fear River basin.

Cape Fear Shiner

Notropis mekistocholas Snelson



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Prepared by Gerald B. Pottern

Spotfin Chub

***Cyprinella monacha* (Cope)**

Description. This report is an updated excerpt from Boles (1983). Jenkins and Burkhead (1984) describe the Spotfin Chub as having a slightly compressed, elongated body ranging from about 20 mm SL early in the first year to about 85 mm SL in the third year of growth. Except for nuptial males, the color is a dusky green above the lateral line and silver on the lower sides; the body is bordered middorsally and dorsolaterally by gold and green stripes. There are no blotches or speckling on the body, but the dorsal fin has a dark area posteriorly, and a caudal fin spot is distinctive. The mouth is inferior with the upper lip expanded anteriad. Terminal small labial barbels are present. Pharyngeal teeth are 4-4. Scales are moderately small with those of the lateral line ranging from 52 to 62. The anal fin has 8 rays. Males have longer dorsal, anal, and pelvic fins than females, and dorsal fin insertion is more anterior. Nuptial males develop antrorse tubercles over most of the top of the head and the front and side of the snout; they have a brilliant metallic blue color above the lateral line, and the fins bear white margins.

Range. The Spotfin Chub formerly ranged in montane Tennessee River drainage of Alabama, Georgia, North Carolina, Tennessee, and Virginia. It is presently extant in only four systems: the Little Tennessee River, North Carolina; Duck and Emory Rivers, Tennessee; and the North Fork of the Holston River, Tennessee and Virginia. In North Carolina it is restricted to a 10.5-mile section of Little Tennessee River above Fontana Reservoir (Alderman 1987). Populations previously reported from the Tuckaseegee and French Broad drainages are apparently extirpated. The warm, dry summers experienced during recent years have allowed the Spotfin Chub's Little Tennessee River population to expand sufficiently to permit reintroduction from there into Abrams Creek in the Great Smoky Mountains National Park.

Habitat. The Spotfin Chub appears to prefer clean, smooth bedrock during the summer through September (McLarney 1988). Later in the year the species prefers gravel/cobble bars, an uncommon habitat in the lower Little Tennessee River of North Carolina. The Spotfin Chub can be found in a river's deep pools during the winter (Charley Saylor, pers. comm. 1986). The presence of alkaline bedrock, mostly of the Copperhill Formation, in the lower Little Tennessee River may be necessary for the development of fertilized eggs and thus may influence the distribution of the Spotfin Chub in North Carolina (Alderman 1987, McLarney 1988).

Status. Federally Threatened.

Life History and Ecology. Cyprinella monacha breeds in the Little Tennessee River from early June through mid-July. Spawning takes place in crevices under loose rock resting on bedrock (McLarney 1988). It matures in 1 year; life span is 4 years. Immature aquatic diptera (mostly chironomids and simulids) are the major food items for the species. It appears that feeding takes place diurnally by both sight and taste (Jenkins and Burkhead 1984).

Special Significance or Unique Characteristics. According to Boles (1983), "... the Spotfin Chub seems to be a phyletic key species linking two large, complex groups of eastern American minnows—shiners *(Notropis)* and certain non-nest building barbeled chubs *(Hybopsis)*."

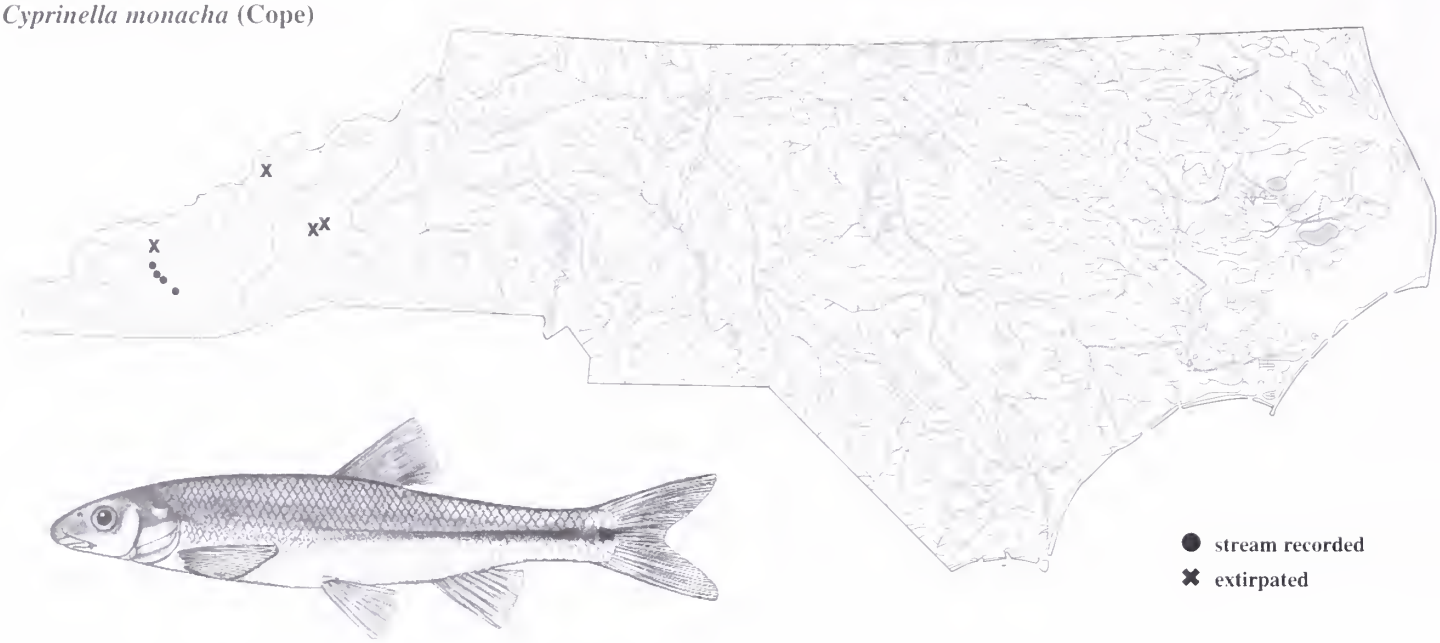
Rationale for Evaluation. Because of restricted distribution and sensitivity to pollution based on extirpation over much of its range, this species has been assigned federal threatened status. Until recent years the species was extremely rare in the lower Little Tennessee River. With continuing threats from impoundments, siltation, and other forms of pollution, the Spotfin Chub's future existence in North Carolina is endangered.

Current Protection. Cyprinella monacha is listed as a Threatened species by the U.S. Fish and Wildlife Service. It is currently protected under the Endangered Species Act of 1973 as amended.

Recommendations. Monitoring and management of the species, its aquatic habitat, and associated terrestrial habitats are important for the continued survival of this species in North Carolina. Reduction of pollution and siltation of the Little Tennessee watershed is recommended. These forms of pollution are becoming increasingly critical, especially during times of low water flow in late summer and fall.

Spotfin Chub

Cyprinella monacha (Cope)



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Prepared by John M. Alderman

Waccamaw Silverside

***Menidia extensa* Hubbs and Raney**

Status: Federally Threatened.

Description. The Waccamaw Silverside is a slender, silvery, nearly transparent minnow-like fish with an adult size of 30 to 66 mm SL. It can be differentiated from other North Carolina silversides by a combination of the following characteristics: body depth 7 to 8 times in standard length, lateral series scales 40 to 44, and anal rays 19 to 21. Both sexes are similar in appearance. Hubbs and Raney (1946) provide complete descriptions and a black and white photograph.

Range. This species is endemic to Lake Waccamaw in Columbus County, North Carolina (Shute et al. 1981).

Habitat. This silverside is found throughout Lake Waccamaw. It prefers open surface waters and often occurs in schools numbering in the thousands.

Life History and Ecology. Menidia extensa is an open-water plankton feeder, preferring cladocerans (Lindquist and Yarbrough 1982). Peak reproduction occurs during April and May, with large females containing about 150 mature eggs and a maximum of 4,500 total eggs (Lindquist and Yarbrough 1982). A few fish live through a second winter. Additional life history information is provided by Davis and Louder (1969).

Special Significance or Unique Characteristics. The Waccamaw Silverside forms a vital link in the food web of this unique lake, providing forage for the many game species occurring there. Additionally, because of its apparent sensitivity, the overall health of the silverside population serves as an environmental indicator of water quality conditions in the lake.

Rationale for Evaluation. Any species endemic to so small a geographic area as Lake Waccamaw deserves close and continued monitoring. Lindquist and Yarbrough (1982) indicate that the status of Lake Waccamaw may be reaching a critical stage with regard to potential eutrophication. This threatens not only the Waccamaw Silverside but also the continued existence of the unique environment of the lake.

Current Protection. The Waccamaw Silverside is currently protected under the Endangered Species Act of 1973 as amended.

Recommendations. Because Lake Waccamaw is a shallow lake with a long residence time, it is highly subject to eutrophication from agricultural runoff, domestic sewage, and lawn fertilizers. Lindquist and Yarbrough (1982) provide extensive recommendations for the continued monitoring of Lake Waccamaw and its endemic fauna. These include frequent analyses of water quality, algal monitoring, and fish sampling to determine trends in population dynamics. Special care should be taken to minimize eutrophication of the lake.

○ lake or reservior recorded

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Prepared by J. R. Shute

State Endangered
Freshwater Fishes of North Carolina

Cutlips Minnow

***Exoglossum maxillingua* (Lesueur)**

Description. The Cutlips Minnow is a medium-sized chubby minnow with a trilobed lower lip with no barbels; the upper lip is not protractile. The olive-brown dorsal grades into the pale venter. Adults reach 95 to 120 mm SL (Gilbert and Lee 1980).

Range. This species occurs in Atlantic drainage streams from the Saint Lawrence River to the Roanoke River (Gilbert and Lee 1980). In North Carolina it has been found only in a quarter-mile section of the Dan River in northern Stokes County (Roanoke River drainage).

Habitat. The Cutlips Minnow prefers clear streams running over gravel, rubble, and boulders relatively free of rooted plants, silt, and sand. It is a bottom-dwelling species found under or near rocks in quiet pools (Gilbert and Lee 1980; pers. obs.).

Life History and Ecology. This species constructs mound-nests of gravel under or near protective logs or rocks and spawns in mid-May through mid-June at temperatures of 18 to 20°C (Maurakis et al. 1991). Young remain in the nest for about 6 days after hatching (Scott and Crossman 1973). The Cutlips Minnow feeds primarily on benthic insect larvae and, to a lesser extent, on worms, crayfish, snails, fish eggs, and algae (Haase and Haase 1975, Jenkins and Burkhead 1994). Normal life span is 2 to 5 years.

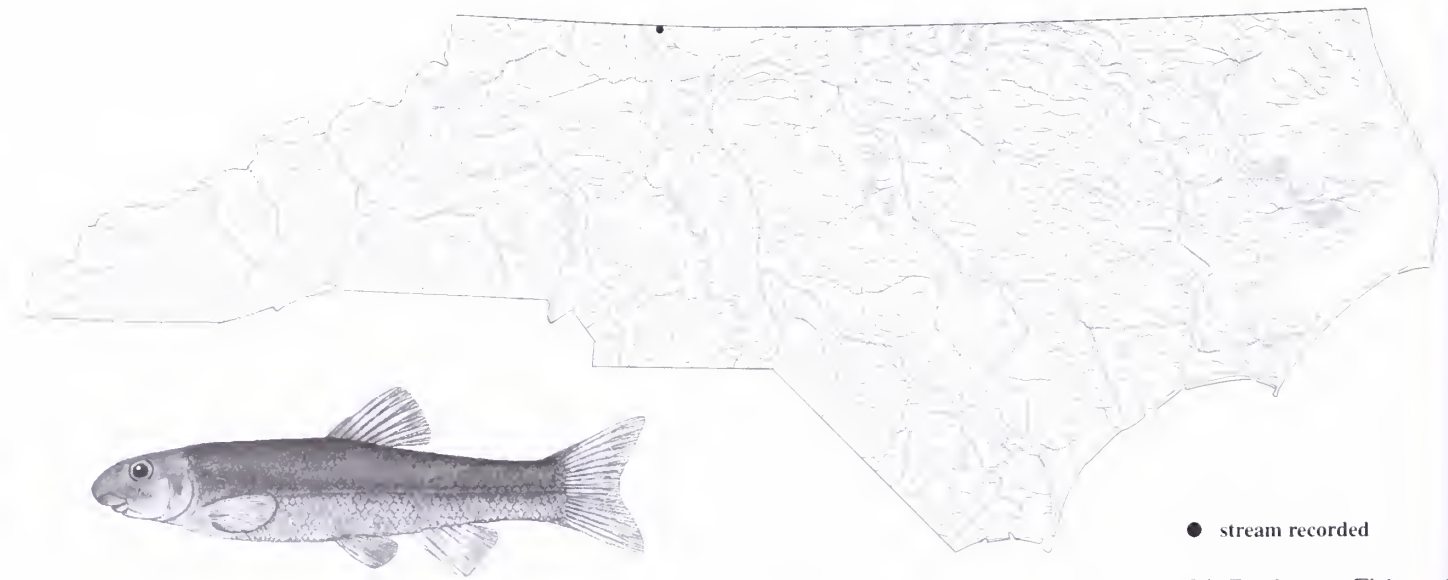
Status: State Endangered.

Special Significance or Unique Characteristics. Jenkins and Burkhead (1994) provide an excellent literature review of the use of the unusual mouth of this species. Individuals have been known to gouge out the eyes of other fishes in crowded conditions using the unusual hard lower jaw, which may also be used to dislodge snails and insect larvae from surfaces or to crush mollusks against the roof of the mouth. The fleshy lateral lobes may aid in the detection of food and the centering of food when eating. The Cutlips Minnow is an indicator of good water quality, along with the Orangefin Madtom (Jenkins and Burkhead 1994). This is a peripheral population, and North Carolina represents the southernmost range of the species.

Rationale for Evaluation. The Cutlips Minnow occurs rarely in a limited section of a single stream in North Carolina, and it is unusually susceptible to siltation.

Current Protection. The Cutlips Minnow is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987.

Recommendations. Habitat improvement with emphasis on reduction of siltation is needed to sustain viable populations of this species.



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Prepared by Edward F. Menhinick

Stonecat

***Noturus flavus* Rafinesque**

Status: State Endangered.

Description. Madtom catfishes are characterized by their generally small size and by having the posterior part of the adipose fin attached to the body. The Stonecat differs from other madtoms by having the band of teeth in the upper jaw with backward lateral extensions, a pale bar behind the head, no serrae on the posterior edge of the pectoral spine, and the caudal and adipose fins edged with yellow (Menhinick 1991). Adults usually vary from 80 to 180 mm SL (Walsh and Burr 1985).

Range. The Stonecat occurs in the St. Lawrence-Great Lakes, Hudson Bay (Red River), and Mississippi River basins from Quebec to Alberta and south to northern Alabama, northern Mississippi, and northeastern Oklahoma; it is also found in the Hudson River drainage, New York (Page and Burr 1991). In North Carolina it is represented by an isolated population in the lower Cane River of the Toe River drainage, where it was first collected in 1984 (Menhinick 1986). Recent records are now available for the Little Tennessee River (one record) and the French Broad River (one record) drainages.

Habitat. The Cane River population occurs in a medium-sized stream in riffles and slow rapids over cobble (pers. obs.). Young prefer slow sand and gravel riffles, often near vegetation (Trautman 1981). Occasionally the species is found in lakes near sand or gravel bars where there is wave action (Trautman 1981).

Life History and Ecology. Life history and ecology are from Walsh and Burr (1985), who provide original data and a review of the literature. This madtom spawns in June and July at a temperature of 28°C. The mass of sticky eggs, deposited in a compact cluster beneath flat stones, is guarded by the male. There are 189 to 570 vitellogenic oocytes; 104 to 208 eggs are present in a nest clutch. The Stonecat lives up to 9 years. It hides under large rocks during the day; at night it feeds on riffle-dwelling insect larvae, crayfish, and small fish.

Special Significance or Unique Characteristics. This species occurs in low numbers at only four sites in the Toe, Little Tennessee, and French Broad River drainages. Populations of the Stonecat in the Cumberland and Tennessee River drainages, including all sites in North Carolina, have a unique pigment pattern on the head and nape and may represent an undescribed species (pers. obs.).

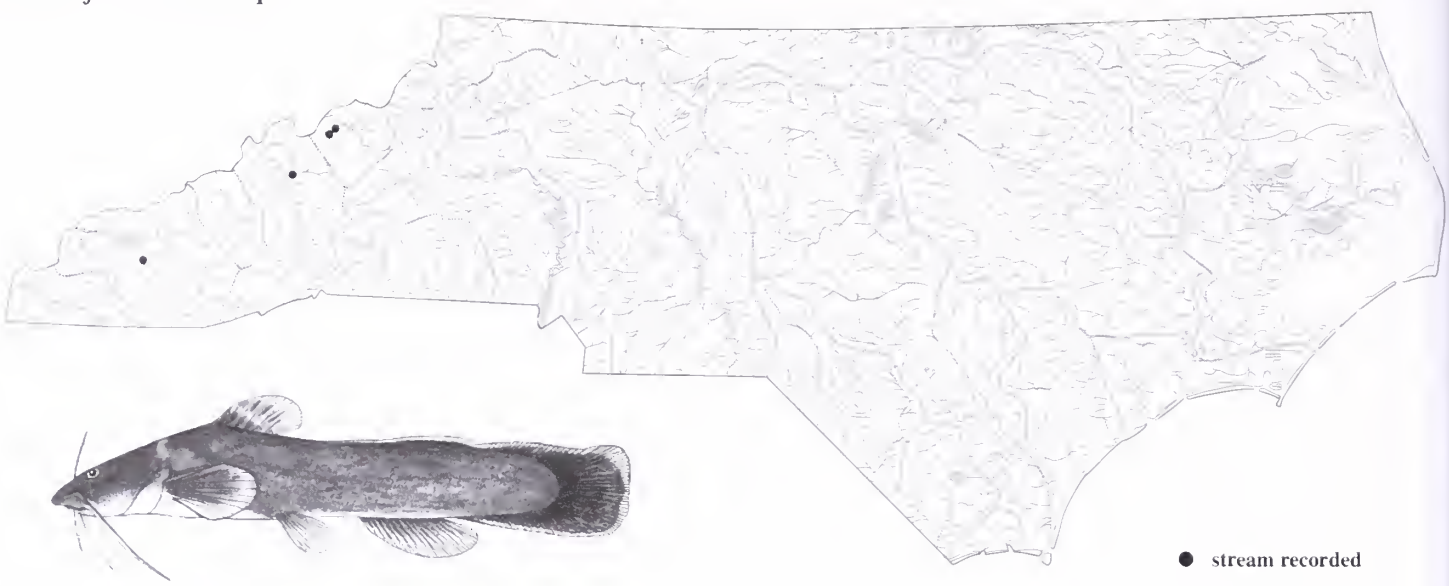
Rationale for Evalution. This species' limited distribution in three isolated streams warrants its assignment to Endangered status in North Carolina

Current Protection. The Stonecat is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987.

Recommendations. It is recommended that additional sampling be made to better determine the range of this species. Periodic monitoring would then indicate changes in the status of the population. These studies would provide the basis for a recovery plan, ensuring the continued existence of the North Carolina population

Stonecat

Noturus flavus Rafinesque



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Prepared by Brooks M. Burr

Orangefin Madtom

***Noturus gilberti* Jordan and Evermann**

Description. A moderate-sized madtom reaching 100 mm SL, *N. gilberti* is characterized by a narrow head, subterminal mouth, short barbels, reduced eyes, and short spines. The dorsum is medium brown to gray with a yellow-olive cast. Ventral surfaces are yellow-olive to white with a slight pink cast. The Orangefin Madtom is distinguished from the Margined Madtom (*N. insignis*), a common, sympatric congener, by caudal fin coloration: *N. gilberti* has a dusky tail with a very narrow, pale posterior and wide, pale dorsal margin, whereas *N. insignis* usually has a pale caudal fin with an entire dark margin. Also, the Orangefin Madtom lacks the black edge on the dorsal, caudal, and anal fins typical of *N. insignis* in the Dan River system of North Carolina. See Taylor (1969) for detailed meristics and a photograph.

Range. The Orangefin Madtom occurs in systems of the upper Roanoke River drainage and in one tributary to the James River drainage. In North Carolina it is known from six locations in the upper Dan River proper from the Virginia border downstream to Danbury (Stokes County).

Habitat. The Orangefin Madtom typically occurs in montane, warm-water streams; juveniles and adults are associated with swift, silt-free riffles dominated by cobble substrate. *Noturus gilberti* is consistently found in riffles with local gradients of 2% or greater (Simonson 1987).

Life History and Ecology. This species spawns from late April to June during its third summer of life. The male probably excavates a nest cavity and remains with embryos and larvae (Bailey and Committee 1977). Females average only 47 eggs during the reproductive period (Burkhead 1983). *Noturus gilberti* feeds on immature benthic insects, primarily small dipteran and trichopteran larvae.

Status: State Endangered.

Special Significance or Unique Characteristics. The Orangefin Madtom is possibly the first madtom diverging from the *Noturus-Pylodictis* hypothetical common ancestry (LeGrande 1981). The stream length occupied by *N. gilberti* in North Carolina is about 20% of the species' total range (Simonson and Neves 1985).

Rationale for Evaluation. Although Orangefin Madtom densities in the Dan River have remained relatively stable for the last few years, they are substantially lower than those of the four Virginia populations, despite the availability of apparently suitable habitat (Simonson 1987). The low population levels may be a result of an altered reproductive period because of cool, hypolimnetic discharges from upstream reservoirs. One apparently ripe female was taken from the Dan River in June 1977, when water temperature was 17°C (Burkhead 1983), about a month after the spawning period peaks in other streams.

Current Protection. The Orangefin Madtom is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987. Although it has no current federal status, it is considered Threatened in Virginia (Jenkins and Musick 1980, Jenkins 1977).

Recommendations. Because impoundment discharges are apparently a major factor limiting the Orangefin Madtom in the Dan River, special care should be taken to ensure that release of cold discharges does not disrupt conditions for continued survival of this species.

Orangefin Madtom

Noturus giberti Jordon and Evermann

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Prepared by Timothy D. Simonson

Blotchside Logperch

***Percina burtoni* Fowler**

Status. State Endangered

Description. The Blotchside Logperch is a large darter ranging in size from 90 to 160 mm TL with a conical fleshy snout and 79 to 94 lateral-line scales. The dorsal fin has 15 to 18 spines and 14 to 16 soft rays. Anal fin soft rays number 11 to 13, pectoral fin rays 14 to 15, and principal caudal fin rays 16 to 17. The modified midventral scales are well developed. The ground color of body and fins is pale yellowish green, and the dorsum has about 11 quadrate saddles interspersed with narrow lines and vermiculations. Vermiculations in the dorsolateral area vary in intensity, as do the 8 or so lateral blotches and suborbital bar. A distinct caudal spot is usually present. The Blotchside Logperch differs from the common logperch *(P. caprodes)* in that it has a broad red margin on the spinous dorsal fin and a series of large black blotches along the lateral-line area. See Etnier and Starnes (1993) for more detailed information.

Range. The Blotchside Logperch is widespread but extremely rare in the Tennessee River drainage. Outside of Tennessee's Little River and Duck/Buffalo River system, it is known to persist in only five additional areas, one of which is a small section of the South Toe River in Yancey County, North Carolina. Populations formerly occurring in the Cumberland River drainage, the Holston River system (except the North Fork) of Tennessee and Virginia, the Little Tennessee River system of Tennessee, and the French Broad River system of North Carolina (Cane Creek and Swannanoa River) are apparently extirpated.

Habitat. Blotchside Logperch occur in flowing pool areas of small to medium rivers with excellent water quality.

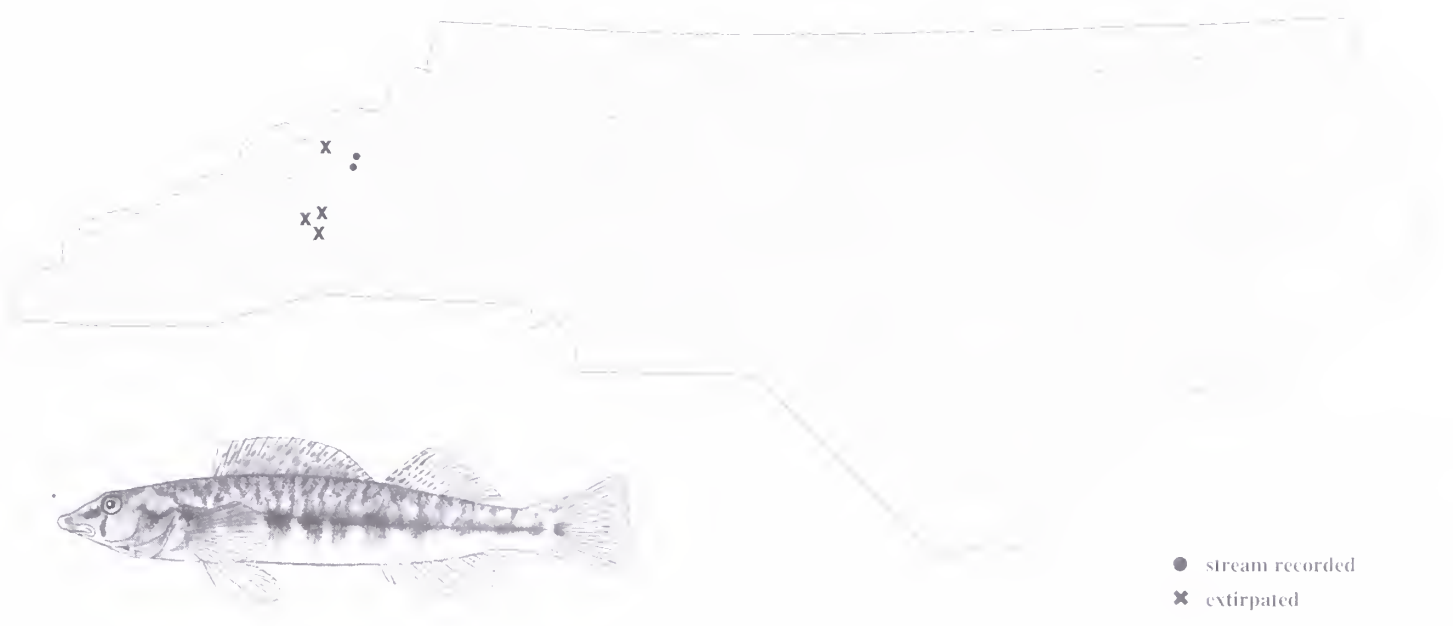
Life History and Ecology. This species' biology is unstudied, but closely related species spawn over gravel riffle areas in April and May, are sexually mature at age 2, and live for 5 to 6 years. When feeding they turn over stones with their long snout to gain access to hiding insect larvae (Etnier and Starnes 1993).

Special Significance or Unique Characteristics. Near pristine water conditions are required for this species; it is probably the most sensitive of all North Carolina fishes to pollution.

Rationale for Evaluation. The species' overall rarity, the fact that it is known to persist in only the finest of our remaining rivers, and the extirpation of many populations, coupled with its largely unknown biology, dictates its Endangered status. Should the North Carolina population be lost, it is unlikely that it could naturally recolonize.

Current Protection. The Blotchside Logperch is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987.

Recommendations. Maintenance of virtually pristine conditions for the South Toe River is probably essential to the survival of *P. burtoni.* Maximal efforts should be employed to reduce pollution and siltation in this stream.



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Prepared by David A. Etnier

Dusky Darter

***Percina sciera* (Swain)**

Status. State Endangered

Description. The Dusky Darter is an elongate fish with no dark subocular bar. Adult size varies from 40 to 110 mm SL. Coloration of the dorsum is grayish with 7 to 9 dark dorsal saddles, which may be distinct, vague, or essentially absent. Males lose their color pattern during the breeding season and become rather uniformly charcoal gray. The cheeks, opercles, and nape are scaled. The anterior belly is often naked. The prepectoral area and the posterior half and lateral margins of breast usually are scaled; the anterior portion of the breast is typically naked but may be fully scaled in males. The preopercular margin is serrate. Modified midventral scales are well developed in males. See Etnier and Starnes (1993) and Page (1983) for more detailed descriptions.

Range. The Dusky Darter occurs in Gulf Coastal drainages from the Tombigbee River portion of Mobile Basin west through the Guadalupe River, Texas, and extending up the Mississippi River drainage to northern Indiana. It is more common in the low gradient habitats of the Coastal Plain but is widespread and locally abundant in the upper Tennessee River drainage of east Tennessee. The only North Carolina record is from a single site in Spring Creek, French Broad River system, Madison County, in 1966.

Habitat. This species occurs in flowing pool areas of medium to large streams over sand or gravel usually in areas of aquatic vegetation, leaves, or underbrush. Young prefer more shallow riffles. Winter is apparently spent in deep pools (Kuehne and Barbour 1983).

Life History and Ecology. Dusky Darters spawn during late spring and early summer (Suttkus and Ramsey 1967), most often in June (Kuehne and Barbour 1983). Eggs are scattered over gravelly riffles 30 to 90 cm deep and are abandoned by the parents. In Illinois, females produce 80 to 200 eggs per year, eggs hatch in about 4 days, and young reach 70 mm total length at age 1. They grow an additional 10 to 12 mm per year during later years, and life span is over 4 years (Page and Smith 1970). Young feed on small riffle-dwelling insects, such as midge and blackfly larvae; adults eat large aquatic insects, such as caddisfly, mayfly, and stonefly immatures (Page and Smith 1970, Miller 1983). They overwinter in deep downstream habitats (Page 1983).

Special Significance or Unique Characteristics. Percina sciera is the only member of the subgenus *Hadropterus* that occurs in North Carolina. The single collection record may represent an isolated remnant of a once more widespread distribution in the state.

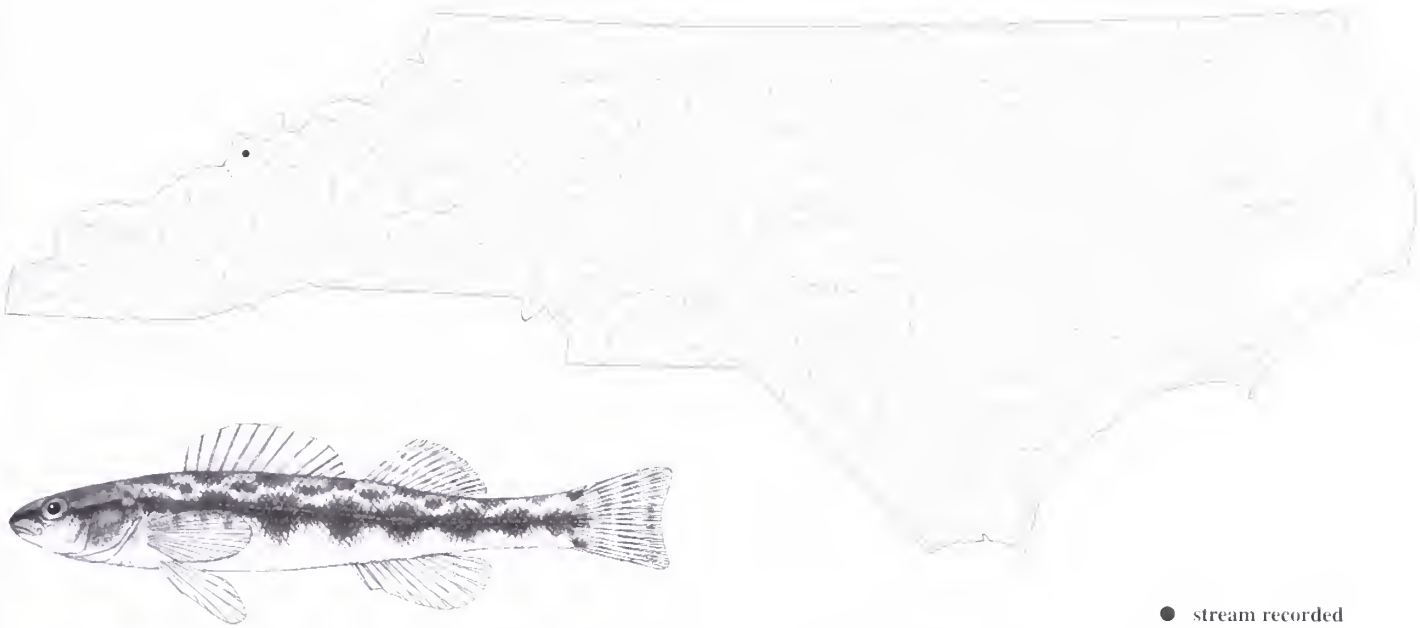
Rationale for Evaluation. Considering the extent of collecting efforts in the French Broad River system, *P. sciera* is presumed to be extremely rare. Recolonization from Tennessee is blocked by a reservoir, and the species could be extirpated by a single catastrophic event.

Current Protection. The Dusky Darter is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987.

Recommendations. The extent and strength of the North Carolina population should be monitored by additional collecting in Spring Creek, in nearby Laurel Creek, and in the French Broad River. This may be a difficult species to collect with seines, as it occurs (usually as a single specimen) in fewer than 1 of 10 collections from known localities in Little River, Tennessee. Efforts to improve water quality in the French Broad River system should be encouraged.

Dusky Darter

Percina sciera (Swain)



● stream recorded

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Prepared by David A. Etnier

Paddlefish

***Polyodon spathula* (Walbaum)**

Status. State Endangered

Description. The Paddlefish is a large, gray fish with a long snout shaped like a canoe paddle. The upper caudal fin lobe is elongate, scales are not apparent, the jaws are toothless in adults, and there are several hundred very long gill rakers. Adults vary from 890 to 1577 mm TL and weigh up to 68 kg.

Range. This unusual fish formerly ranged throughout much of the Mississippi Valley and adjacent Gulf slope drainages, from the San Jacinto River, Texas, east to the Mobile Bay basin, Alabama (Burr 1980). It is considered extirpated from the Great Lakes basin and other areas on the periphery of its range (Gengerke 1986). It is generally declining throughout much of its range because of habitat loss, pollution, and overfishing. In North Carolina early reports indicated that it once ascended the French Broad River up to Asheville (Cope 1870). There is a recent report that a fisherman caught one during the week of 10 October 1983, but this catch was not verified (Gengerke 1986). It is present in Douglas Reservoir, the first downstream reservoir on the French Broad River in Tennessee.

Habitat. The Paddlefish occurs in large rivers and the lower reaches of major tributaries that are rich in zooplankton. It also is found in bayous, river-lakes, and impoundments with access to spawning sites. Individuals tend to congregate in pools below sand bars, near big islands, or near shoreline irregularities, dikes, and bridge supports, where water velocity is reduced (Russell 1986).

Life History and Ecology. The following comments are summarized and paraphrased from Russell (1986). Paddlefish may travel great distances to reach spawning areas; migration is triggered by increased stream flow associated with spring rains. Spawning occurs mainly from March to June at water temperatures of around 13°C in flowing water over gravel substrate. Females may spawn only once every 2 to 5 years; mean egg production in Mississippi River fish is about 17,000 per kg of body weight. It is believed that several males accompany a female in a spawning "rush" to the surface, where eggs are released and fertilized. The adhesive eggs attach to the gravel and hatch in 9 days. Paddlefish mature in 8 to 12 years and live up to 30 years. The species grows rapidly; when food is unlimited, young may reach more than 500 mm TL during their first year. By about age 5 the species grows at a rate of approximately 50 mm per year. Between 5 and 10 years of age they may double or triple their weight. Females (14 kg) are larger than males (7 kg). Paddlefish use sensory receptors on the snout to detect concentrations of zooplankton, which are filtered with the numerous long, thin gill rakers; fish and insects are eaten rarely.

Special Significance or Unique Characteristics. The Paddlefish is one of the most unusual animals in the world and is one of only two living species of an ancient order (the other species occurs in China). Its unique phylogenetic position, bizarre appearance, large size, high value of the roe ($200 per fish), and fine flesh make it of extraordinary significance.

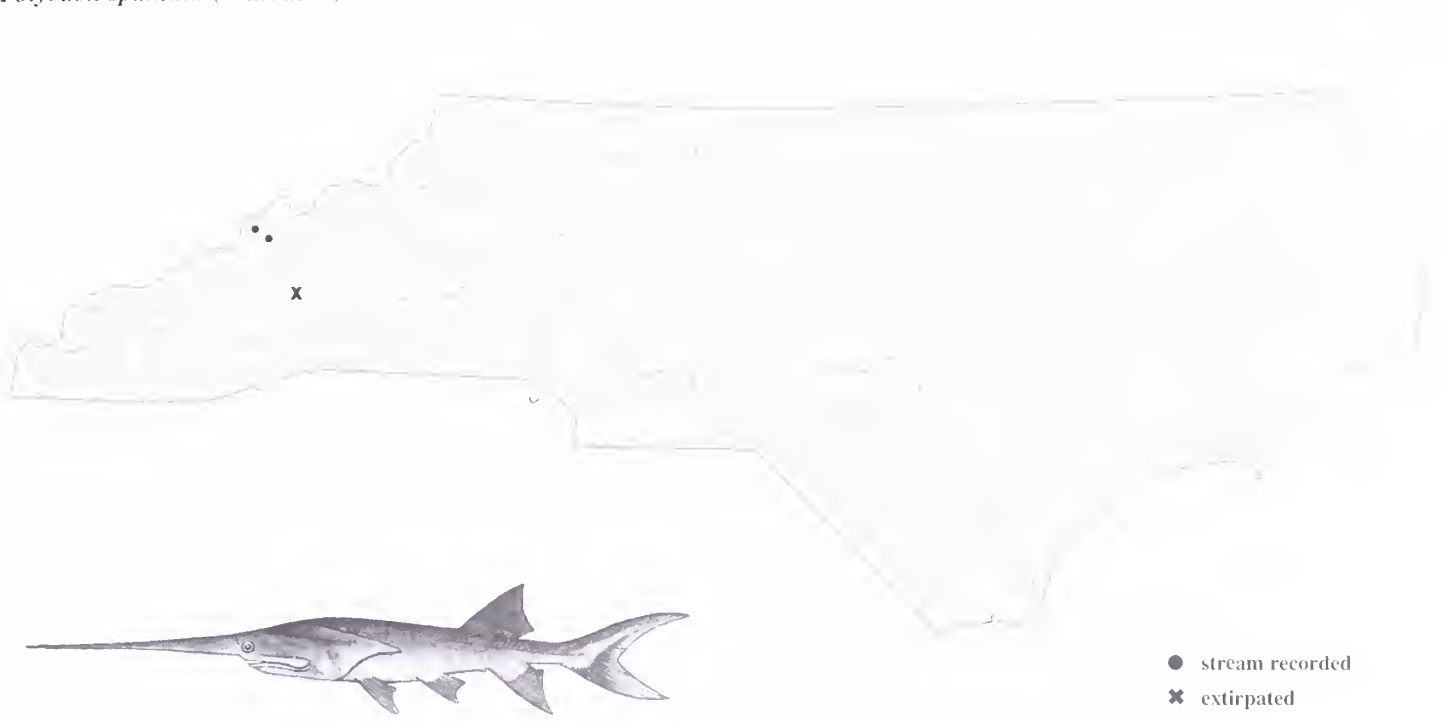
Rationale for Evaluation. Because siltation and pollution have destroyed the prime spawning site on the French Broad River for the Douglas Reservoir population, this species is in serious danger of disappearing from the state and from Douglas Reservoir.

Current Protection. The Paddlefish is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987.

Recommendations. Efforts to restore the species must concentrate on cleaning up the French Broad River. Searches in the lower French Broad River and other major tributaries of Douglas Reservoir should be made during the spring spawning season to determine if seasonal migrations occur in North Carolina. Destruction of unidentified spawning sites could become the most serious threat to the Paddlefish resource. Although techniques for producing and stocking this species are known, stocking would be useless without habitat improvement.

Paddlefish

Polyodon spathula (Walbaum)



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Prepared by Brooks M. Burr

Rustyside Sucker

***Thoburnia hamiltoni* (Raney and Lachner)**

Description. This is a small, striped sucker with two large light blotches at the base of the caudal fin. It belongs to a group of suckers characterized by a sucker-like mouth, a cylindrical body, and 10 dorsal rays. It has 16 caudal peduncle scales, horizontal dark and light stripes on the sides of the body, a plicate upper lip, and a lower lip that is papillose posteriorly and flared posteriorly to form a free flap (Menhinick 1991). Coloration is olive brown above with diffuse dark spots and pale below. Adults reach 75 to 125 mm SL (Jenkins 1994).

Range. The Rustyside Sucker is endemic to the upper Dan River system of the Roanoke drainage (Jenkins 1980). In North Carolina it has been known since 1986 from one site on the Little Dan River near the Virginia state line (Menhinick 1986). There is a recent record from the Dan River in Virginia (Jenkins and Burkhead 1994).

Habitat. This species prefers small, cold to warm, high gradient, clear streams. Adults prefer runs and riffles over gravel, rubble, boulder, and bedrock (Jenkins 1980); however, specimens collected at the Little Dan River location were in about 60 cm deep pools (pers. obs.). Juveniles occur in flowing pools and

Status. State Endangered

are sensitive to moderate siltation (Jenkins 1979).

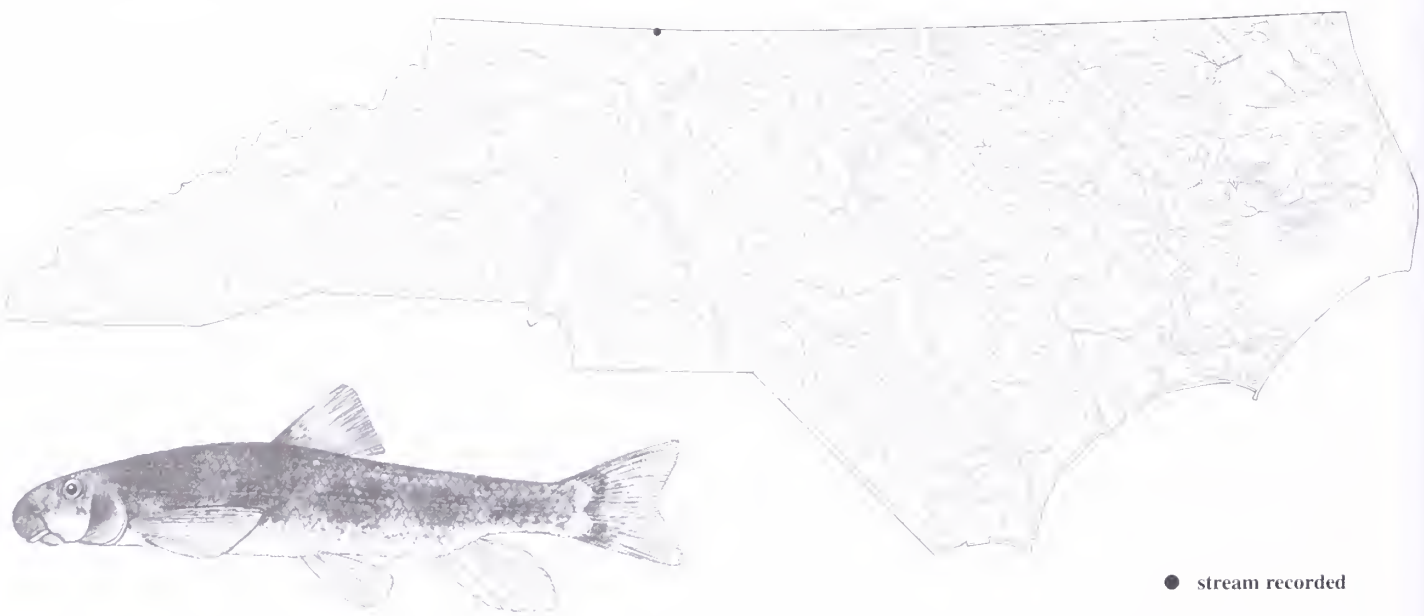
Life History and Ecology. The Rustyside Sucker spawns in April, matures in 2 to 4 years, and lives up to 4 years. It feeds o organic floc and also eats small numbers of insect larvae (Jenkins 1980).

Special Significance or Unique Characteristics. This species is more common in nearby streams in Virginia, but the small population in the Little Dan River is the only one known in North Carolina.

Rationale for Evaluation. This species' very limited distribution and sensitivity to siltation warrants its assignment to Endangered status in North Carolina.

Current Protection. The Rustyside Sucker is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987.

Recommendations. Further research should concentrate on pollution sensitivity and biology. Introduction into other streams in the upper Dan system of North Carolina, where it may have once occurred, might be investigated.



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Prepared by Edward F. Menhinick

Freshwater Drum

***Aplodinotus grunniens* Rafinesque**

Status. State Threatened.

Description. This spiny-rayed fish has a compressed body and a rounded snout. The Freshwater Drum differs from other spiny-rayed fishes by the presence of 2 anal spines, the second of which is thick and at least 3 times longer than the first; the soft part of dorsal fin is unusually long and has 26 to 32 rays; the lateral line extends into the round or slightly pointed caudal fin; and the head contains large cavernous canals. The gray coloration of the back gradually fades to silvery gray below. Adult size varies from 420 to 710 mm SL (Pflieger 1975).

Range. This species occurs in large streams of most Gulf of Mexico drainages and extends north to Hudson Bay; it is also in the Saint Lawrence drainage. In North Carolina it occurs only in Spring Creek and in the lower French Broad River below Redmon Dam, Madison County, where it is uncommon (Menhinick 1986).

Habitat. The Freshwater Drum lives near the bottom of large pools of rivers and lakes (Pflieger 1975). Although it prefers clean water, it may be found in a wide variety of habitats and can tolerate turbid waters and silty substrates (Trautman 1981).

Life History and Ecology. Life history and ecology data are from Etnier and Starnes (1993), Pflieger (1975), and Fremling (1978, 1980). The Freshwater Drum is a bottom feeder and moves stones with its snout to expose insect larvae, crayfish, and fishes upon which it feeds; its stout molariform pharyngeal teeth may be used to crush mollusks, another food source. In late April to May, when water temperatures reach 18 to 20°C, this species migrates from rivers to small streams for spawning. By rubbing muscles against their air bladders, sexually mature males produce a drumming sound thought to be associated with spawning activities. Spawning takes place in midwater; the female lays about 50,000 eggs, which float downstream; the fry are planktonic. Growth for the first three years is about 12, 26, and 34 cm, respectively, after which it grows about 4 cm per year; it lives about 11 years.

Special Significance or Unique Characteristics. This is the only species of drum in the fresh waters of North America. Because of its large size, fighting abilities when hooked, and edible flesh, it is an important sport and commercial fish where it occurs commonly.

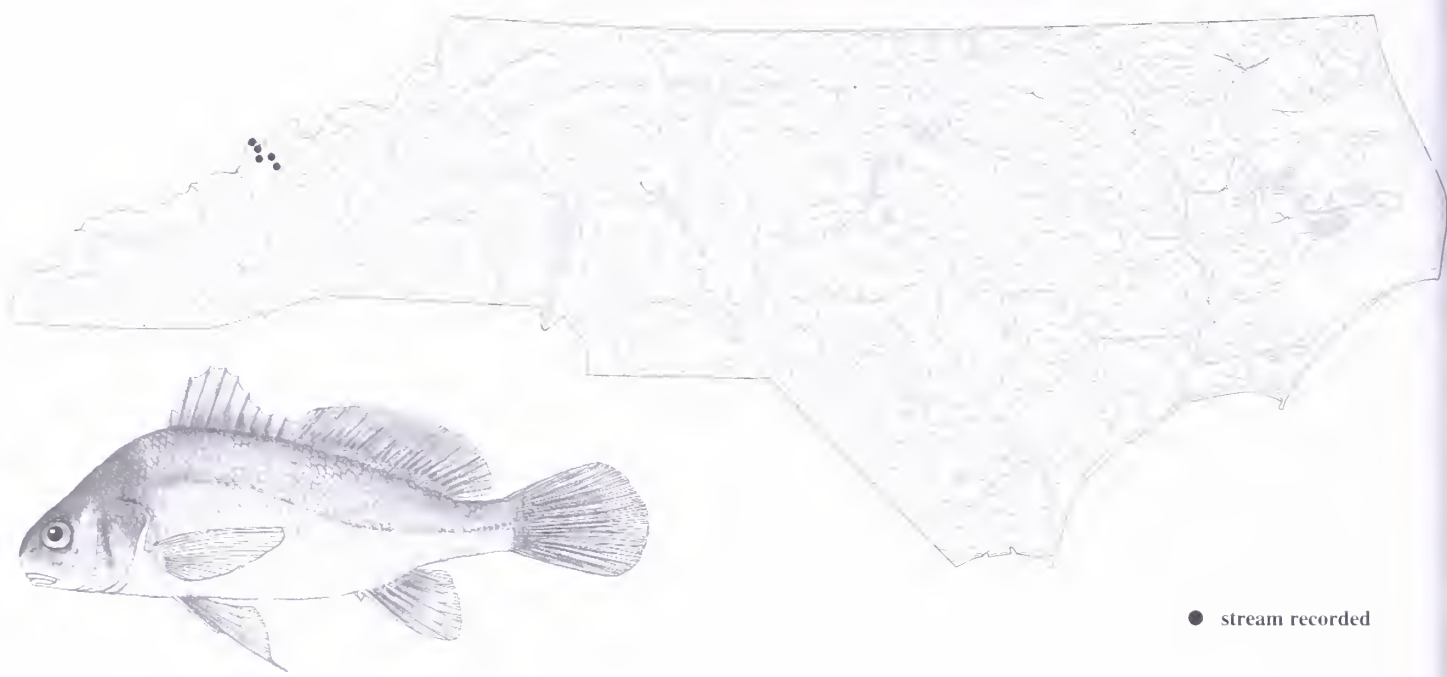
Rationale for Evaluation. The restricted distribution and uncommon occurrence of the Freshwater Drum would indicate Endangered status; however, because of the potential of upstream migration from Tennessee, it is assigned Threatened status in North Carolina.

Current Protection. The Freshwater Drum is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987.

Recommendations. Reducing pollution in the French Broad River should be the primary goal directed toward maintaining present populations of this species. Attempts to reintroduce it into the French Broad River above Redmon Dam should be investigated.

Freshwater Drum

Aplodinotus grunniens Rafinesque



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Prepared by Edward F. Menhinick

anded Sculpin

***ottus carolinae* Gill**

Description. The Banded Sculpin ranges in size from 70 to 45 mm SL. The ground color is most often rusty brown with 4 ark dorsal saddles, at least the posterior 3 of which are typical- distinct. The color of the body is variable depending on sub- rate and water clarity. Banded Sculpins can easily be confused ith western North Carolina forms of *C. bairdi* (Mottled culpin) but differ from them in that the Banded Sculpin has a ode of 16 or 17 pectoral fin rays (15 in *C. bairdi*).

Range. Banded Sculpins are widespread and abundant in ie Ozarks, the Tennessee, Cumberland, and Ohio River rainages, and in Mobile Basin. They extend upstream nearly the North Carolina border in Tennessee River tributaries in ist Tennessee. North Carolina records are from the French Broad iver system near the Tennessee border (Robins 1954) and Sheetin reek near Hot Springs (1994; Menhinick, pers. comm.).

Habitat. This species occurs in riffle areas from tiny spring ms to large rivers. Where *C. carolinae* and *C. bairdi* occur in ie same stream, *C. carolinae* typically occurs in the more wnstream areas, but broad areas of sympatry often occur.

Life History and Ecology. Banded Sculpins breed during inter and early spring, with the male defending a nest site nder a stone or other object. Kentucky females produce about 75 eggs per year, and in these populations total lengths of 50 80, 100 to 130, and over 160 mm were reached at ages 1, 2, and 3, respectively; maximum life span is probably 4 years (Craddock 1965). Banded Sculpins are voracious predators, feeding as adults on large aquatic insects, small fishes (especially darters), salamanders, and crayfish (Small 1975, Starnes 1977).

Special Significance or Unique Characteristics. Recent collections show that the Banded Sculpin is now absent in Laurel Creek and Spring Creek, indicating unusual sensitivity to pollution.

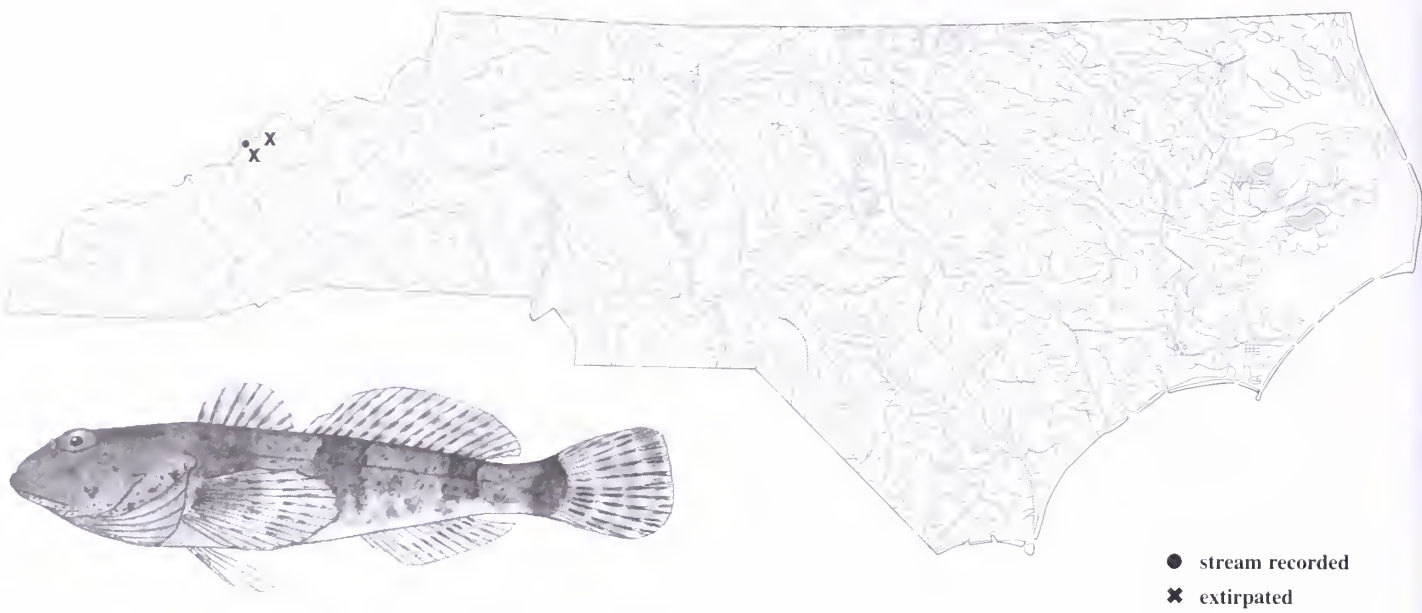
Rationale for Evaluation. Although *C. carolinae* has apparently been extirpated from Laurel and Spring creeks (Madison County), Harned (1979) collected it very close to North Carolina in the French Broad River in Tennessee and Menhinick collected it from Sheetin Creek. Reduction of the distribution in North Carolina coupled with the very small range in this state suggests a high protection status for this species. However, the possibility of natural recolonization from an adjacent Tennessee population and the fact that it is a peripheral species that is common elsewhere supports its Threatened status.

Current Protection. The Banded Sculpin is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987.

Recommendations. Efforts to improve water quality in the French Broad River system should be strengthened. Periodic sampling to monitor the species' status should be conducted.

Status. State Threatened.

Banded Sculpin
Cottus carolinae Gill



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Prepared by David A. Etnier

Carolina Pygmy Sunfish

***Elassoma bochlkei* Rohde and Arndt**

Description. This is one of the smallest *Elassoma,* with a mean adult size of 19 mm SL. There is a series of 10 to 16 (mode 13) narrow, dark bars on the trunk. It lacks the shoulder blotches, subocular bar, and postocular stripe that are prominent in the banded pygmy sunfish, *E. zonatum.* In life the male has brilliant green-blue bars on the trunk between the dark bars; females are nondescript, with faint dark trunk bars (Rohde and Arndt 1987).

Range. The Carolina Pygmy Sunfish is known only from three areas. In South Carolina it occurs at one locality in the middle Santee River drainage and in rice fields in the lower Waccamaw River drainage. In North Carolina it is known from a roadside ditch adjoining Big Creek, a tributary of Lake Waccamaw, Columbus County, and in the Juniper Creek system, which joins the Waccamaw River below Lake Waccamaw, Brunswick and Columbus Counties.

Habitat. This sunfish prefers the heavily vegetated edges of slow-moving streams and water-filled roadside ditches; *Juncus repens* and *Sphagnum* sp. are often common in its habitat. It is often associated with the Everglades Pygmy Sunfish, *E. everglladei.* It occurs in unusually acidic streams.

Life History and Ecology. The Carolina Pygmy Sunfish breeds in late spring (April–May). If it is similar to other *Elassoma,* it lays 25 to 30 eggs per lot (female lays 200 eggs per year) in aquatic vegetation, with an incubation time of about 65 hours; maturity occurs in 1 year. Few fish survive beyond an age of 12 to 15 months. It feeds by sight, primarily on copepods, ostracods, and cladocerans (pers. obs.).

Special Significance or Unique Characteristics. This species was first collected in the state in 1961. Unusual restriction to areas of acidic conditions makes this a species of special interest in studies of resistance to acid precipitation.

Rationale for Evaluation. Despite extensive collecting in the region of North Carolina where it occurs (Shute et al. 1981; E. F. Menhinick, pers. comm.), the Carolina Pygmy Sunfish is known from only two creeks. The population adjoining Big Creek is small and thus especially vulnerable to any habitat alteration. Juniper Creek supports a healthy population. A large population in a roadside ditch adjacent to lower Juniper Creek was threatened by a proposed North Carolina Department of Transportation bridge relocation until personnel from several regulatory agencies made suggestions on how to save it.

Current Protection. The Carolina Pygmy Sunfish is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987. It was listed in the U.S. Federal Register, Vol. 50, No. 181, p. 37961, 18 September 1985, and is under consideration for addition to the Federal Threatened Species List.

Recommendations. The Juniper Creek watershed should be maintained in its present, fairly pristine condition. Further studies on the species life history, ecology, and tolerance to acidic conditions are needed.

Status. State Threatened.

Carolina Pygmy Sunfish

***Elassoma boehlkei* Rohde and Arndt**

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Prepared by Fred C. Rohde

Sharphead Darter

***Etheostoma acuticeps* Bailey**

Description. The Sharphead Darter is a moderate-sized darter with an elongate and narrow snout. Longitudinal streaks occur along each scale row, the opercle and nape have no scales, and the gill membranes are moderately joined. Adults vary from 40 to 70 mm SL. Males are dark olive with 11 to 16 brown vertical bars, and their ventrolateral areas, including the breast, are cast with blue-green. The first dorsal fin is dark olive with a black anteriodorsal spot; other fins are marginally to almost completely blue-green. Breeding females are straw olive with less conspicuous vertical bars, have olive-brown pectoral fins, and are straw yellow to yellow ventrolaterally. See Bailey (1959) and Page (1983) for a more complete description.

Range. This fish is endemic to the South Fork of the Holston River in Virginia and Tennessee and the Nolichucky (Toe) River of Tennessee and North Carolina. It is extirpated from the South Fork Holston in Tennessee and the North Toe River above Spruce Pine in North Carolina. In North Carolina it occurs in the lower Cane River, and, because of reduction of siltation from mica mining and a 100-year flood that removed much accumulated silt, populations now occur also in the North Toe-Nolichucky River near the confluence of the Cane River (Haxo and Neves 1984).

Habitat. This darter typically occurs in the faster runs and riffles of warm-water streams over gravel and cobbles, often encrusted with riverweed *(Podostemum).* It appears to be ecologically separated from closely related species by its mouth position, preference for fast water, and common association with riverweed (Bryant 1979).

Life History and Ecology. This species probably spawns from late June through mid-August and hence is considered a late spawner (Stiles 1972, Bryant 1979). Sexual maturity is attained at age 1, and longevity is 3 years (Kuehne and Barbour 1983). Spawning females apparently bury their eggs in sandy substrate among rocks in riffle areas (Bryant 1979). Fecundity ranges from 100 to 300 eggs and is apparently correlated with body size (Bryant 1979). The species feeds on benthic invertebrates, particularly blackflies, mayflies, and midges (Jenkins and Burkhead 1975, Bryant 1979).

Special Significance or Unique Characteristics. This species is the only member of the subgenus *Nothonotus* that has an unscaled opercle and that lacks red-orange pigmentation (Page 1983).

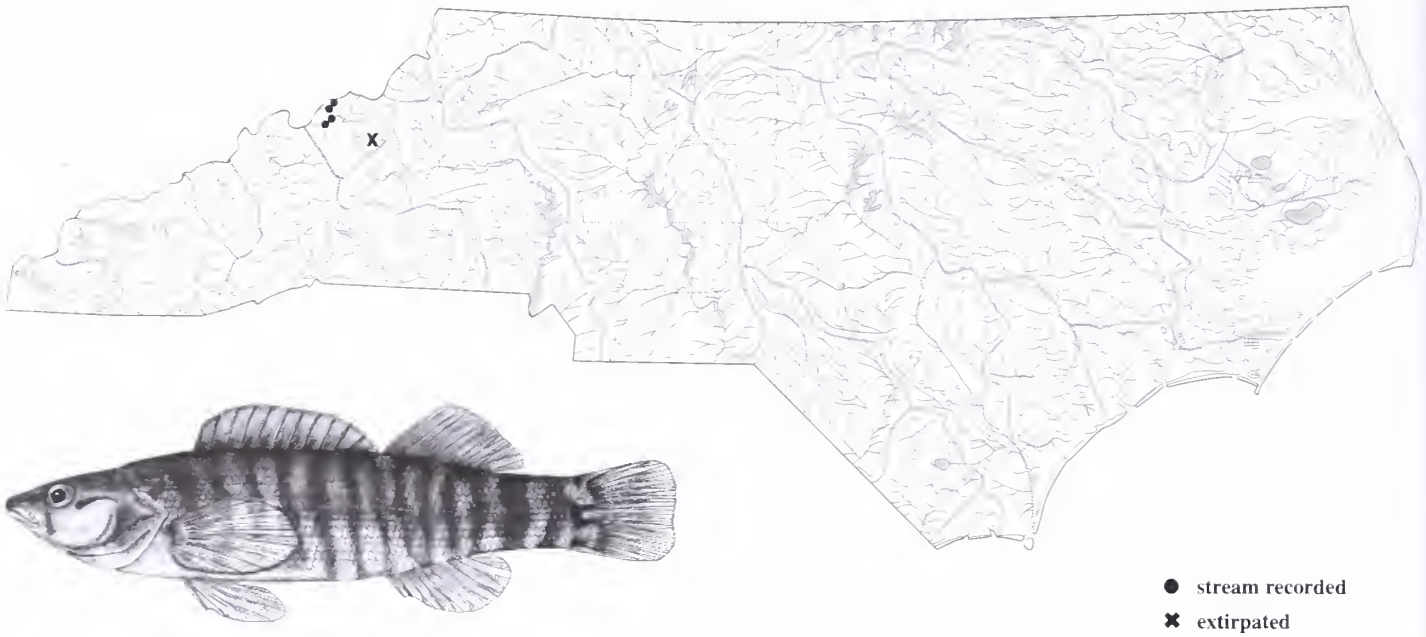
Rationale for Evaluation. Based on extirpation of the population in the North Toe River and on near extirpation of the Cane River population after construction of a bridge on the Cane River, this species is unusually sensitive to siltation. Because of this and because of its limited range, the Sharphead Darter is assigned Threatened status in North Carolina.

Current Protection. The Sharphead Darter is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987.

Recommendations. The extirpation in the North Toe River and the decline in other areas probably resulted from deterioration of water quality caused by mica and silicon mining, industrial and municipal wastes, and siltation. Better enforcement of pollution and mine siltation standards will improve conditions for this species and its food organisms. With these corrective actions, the species should maintain or slightly expand its present range; however, siltation is presently increasing in the lower Nolichucky River. If water quality is now satisfactory in the North Toe River above Spruce Pine where the species once occurred, reintroductions might be attempted.

Status. State Threatened.

Sharphead Darter
Etheostoma acuticeps Bailey



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Prepared by Richard J. Neves

Waccamaw Darter

***Etheostoma perlongum* (Hubbs and Raney)**

Description. The Waccamaw Darter differs from other members of the subgenus *Boleosoma* in that it is a more attenuate, finer scaled species. There are 59 to 64 lateral-line scales, and the nape and the cheek are well scaled. Adults range from 45 to 75 mm SL and males are larger than females (Shute et al. 1982). Breeding males become considerably darker than females and nonbreeding males. Page (1983) and Kuehne and Barbour (1983) provide detailed analyses and color photographs of this species.

Range. Although this taxon was originally described as a species endemic to Lake Waccamaw (Hubbs and Raney 1946), Shute (1984) demonstrated that it ranges down the Waccamaw River, where it intergrades clinally with the Tessellated Darter, *E. olmstedi.*

Habitat. The Waccamaw Darter is common in the nearshore waters of Lake Waccamaw during spring and summer months and undergoes a migration to the middle areas of the lake in late fall and winter. Both in the lake and in the Waccamaw River it seems to prefer relatively clean, sandy substrate.

Life History and Ecology. This darter is unique among other *Boleosoma* studied because it is an annual species (Shute et al. 1982). Breeding occurs from early April through late June (Lindquist et al. 1981). Males excavate a cavity under nearly any stationary object (typically, submerged wood is the available substrate in Lake Waccamaw), and eggs are laid on the undersurface of that object (Lindquist et al. 1981). One female spawns 40 to 50 eggs at a time. A nest typically consists of eggs deposited by more than one female and can contain about 1,200 eggs, which are guarded by a male until hatching occurs. These darters feed primarily on benthic insect larvae. Lindquist et al. (1981) and Shute et al. (1982) provide extensive life history information on this fish.

Status. State Threatened.

Special Significance or Unique Characteristics. Shute (1984) conducted morphological and biochemical analyses of the *E. perlongum/E. olmstedi* complex. Populations in the upper Waccamaw River grade to *E. olmstedi* in the lower Waccamaw River, and electrophoretic studies using 16 enzymes revealed few differences with *E. olmstedi.* Shute concluded that, although the Waccamaw Darter should not receive specific taxonomic status, it is a unique and interesting form from an evolutionary standpoint. In addition, the annualism exhibited by the lake form is rare among darters and unknown in any other *Boleosoma.*

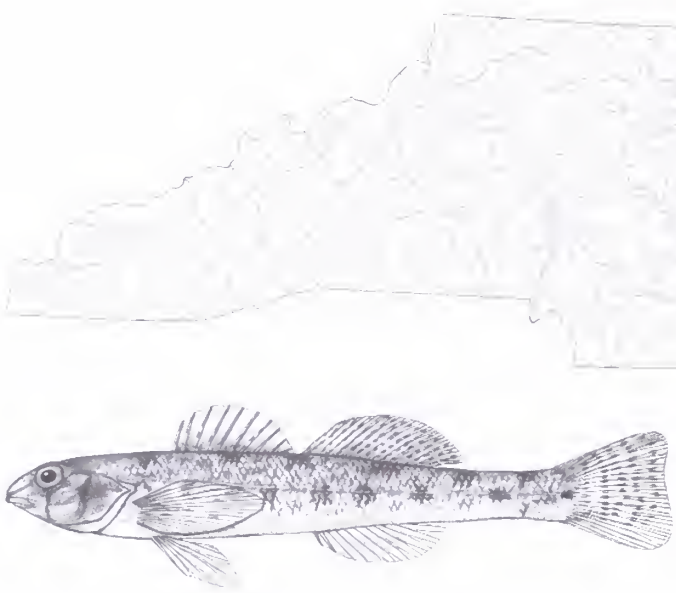
Rationale for Evaluation. Density of Waccamaw Darters is presently stable. The lake dwelling, annual form is especially vulnerable, however, as a short-term event could eliminate the population by interfering with successful reproduction. Habitat modification and/or water quality degradation, particularly eutrophication (Lindquist and Yarbrough 1982), could threaten this population and the ecology of Lake Waccamaw in general.

Current Protection. The Waccamaw Darter is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987. It also has indirect protection because of its occurrence with the Federally Threatened Waccamaw Silverside, *Menidia extensa.*

Recommendations. The Waccamaw watershed should be monitored and steps should be taken to ensure the well-being of this unique area. In addition, because of the short life span of the Waccamaw Darter, regular monitoring should be done to observe any population trends.

Waccamaw Darter

Etheostoma perlongum (Hubbs and Raney)



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Prepared by J. R. Shute

Rosyface Chub

***Hybopsis rubrifrons* (Jordan)**

Status. State Threatened.

Description. The Rosyface Chub is a cylindrical fish with bright red breeding colors and a well-developed barbel. It differs from other chubs by a combination of the following characteristics: the mouth is inferior; there is a dusky stripe on the sides; the eye is large; and there are 8 anal rays and 1,4-4,1 pharyngeal teeth. Adults reach 70 mm SL (Clemmer 1971, 1980).

Range. The Rosyface Chub occurs in the Piedmont of the Savannah River drainage of North Carolina and South Carolina to the Altamaha River in Georgia; it also occurs in the main stream of the Savannah River below the Fall Line (Clemmer 1980). In North Carolina it is restricted to lower stretches of the Horsepasture and Toxaway Rivers between the falls and Lake Jocassee of the Savannah River drainage (Menhinick 1986).

Habitat. Its preferred habitat is small to moderate-sized streams in slightly moving water near the break of a riffle or edge of a depression or a pool (Clemmer 1971). In larger streams it is usually found near the banks in eddy currents over relatively unsilted areas of hard packed sand or gravel (Clemmer 1980).

Life History and Ecology. The Rosyface Chub spawns from mid-April through June at water temperatures of 19 to 20°C. Spawning occurs over clean gravel in moderately fast riffles (Clemmer 1980). Little is known of the feeding habits of this species; it probably feeds mostly by sight on small aquatic and terrestrial arthropods.

Special Significance or Unique Characteristics. The North Carolina localities represent the northernmost populations of this peripheral species.

Rationale for Evaluation. Because of its limited distribution and the blockage of access from downstream areas by Lake Jocassee, this species is assigned State Threatened status.

Current Protection. The Rosyface Chub is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987.

Recommendations. Although Horsepasture Gorge is listed as a wild and scenic river, and the Federal Wild and Scenic Rivers Act and the North Carolina Natural and Scenic Rivers Act ensure the free-flowing nature of the river, neither act controls siltation or discharge to any great extent. Therefore, emphasis should be placed on improving waters in the upper Savannah drainage, especially in view of the rapid development of the area between Highlands and Lake Toxaway.

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Prepared by Edward F. Menhinick

American Brook Lamprey

***Lampetra appendix* (DeKay)**

Description. Lampreys are snake-shaped fishes with no scales; they have a funnel-shaped mouth, 7 gill apertures on each side of the body, a single median nostril, and no paired fins. The American Brook Lamprey is the only Tennessee drainage lamprey with a deeply notched dorsal fin. Adults have moderately developed dorsal teeth and 63 to 70 myomeres. Adults reach 99 to 212 mm TL.

Range. This lamprey occurs in the Saint Lawrence River basin, the Mississippi (but not Missouri) River basin, and the Atlantic slope from New York to the Chowan River basin of Virginia. Rohde (1979) recognized three subspecies, one of which, *L. a. wilderi,* is found in the lower Chowan River drainage of Virginia just above the North Carolina state line. It is also fairly common in tributaries of the Tennessee River in eastern Tennessee (Rohde 1979). In fall 1980 the first record of the American Brook Lamprey from North Carolina was collected in Spring Creek near its junction with the French Broad River at Hot Springs, Madison County, a few kilometers above the Tennessee state line.

Habitat. Ammocoetes larvae of the American Brook Lamprey are found in quiet waters with silt substrate in small creeks to small rivers. The Spring Creek population occurs in silt beds along both sides of the stream below a riffle area.

Life History and Ecology. Spawning occurs in April. Adults move to the upper end of gravel areas near larval beds and use their suction mouths to move stones to construct a pit into which about 1,000 eggs are spawned. In about 4 days these hatch into ammocoetes larvae that burrow into silt. They obtain nourishment by straining plankton and organic particles from the water and from bottom sediments. They develop for 5 years and transform into adults in late summer over a period of several weeks. Adults do not feed, and they die shortly after spawning in the spring.

Status. State Threatened.

Special Significance or Unique Characteristics. This is the only known population of this species in the state.

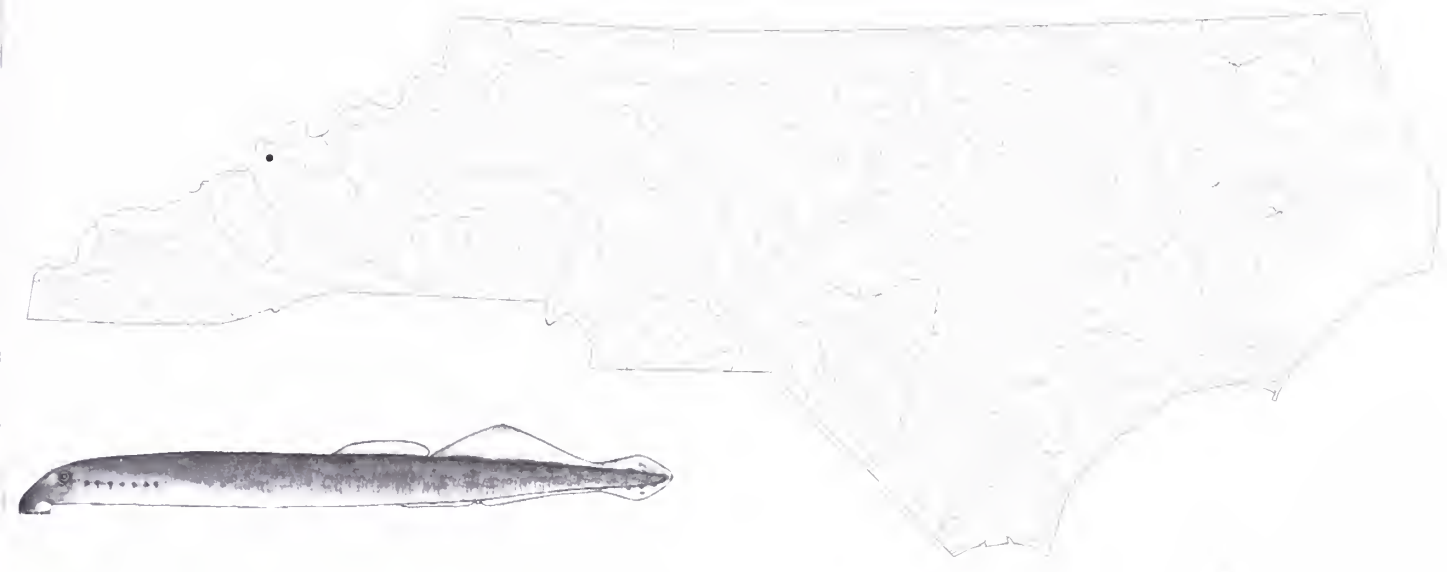
Rationale for Evaluation. Because of limited distribution, this population is in potential danger of extirpation. However, it might be repopulated via migration up the French Broad River from Tennessee.

Current Protection. The American Brook Lamprey is currently protected under Article 25. "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987.

Recommendations. Silted areas are seldom sampled in routine fish surveys, and lampreys are seldom collected with seines or rotenone. Additional samples, using electrofishing equipment, need to be taken both in Spring Creek and nearby streams and in other Tennessee drainage streams where lampreys might occur to better determine their distribution and abundance.

American Brook Lamprey

Lampetra appendix (DeKay)



● stream recorded

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Prepared by Fred C. Rohde

Striped Shiner

***Luxilus chrysocephalus* (Rafinesque)**

Status. State Threatened.

Description. The Striped Shiner is a large, thick-bodied shiner with 2 to 3 wavy, dark, horizontal lines of scales along the upper sides. As a minnow it is characterized by a single dorsal fin with no spines and the absence of scales on the head. It differs from other minnows by a combination of the following characteristics: thick body; 2 to 3 wavy, dark, horizontal lines along the upper sides; deep anterior lateral-line scales; and thin, dark, vertical lines on the sides of adults. There are 13 to 16 large predorsal scales, 9 anal rays, and 2,4-4,2 pharyngeal teeth. Background coloration is silvery (pink in breeding males). Adults vary from 65 to 100 mm SL (Gilbert 1980). See Gilbert (1964) for a detailed consideration of this species, which he separated from *L. cornutus*.

Range. The Striped Shiner is common in the Mississippi River drainage (excluding the Missouri) and in the Mobile River basin (Gilbert 1980). In North Carolina it is known from six locations in the Cane River near Burnsville, Yancey County, Toe River drainage.

Habitat. This shiner occurs in schools in midwater areas of small to medium, clear, weedless streams of moderate to swift current with sand, gravel, or rubble substrate, often with some silt (Gilbert 1980). Pool areas with gravel and pebble substrate protected by brush are often preferred in North Carolina (pers. obs.).

Life History and Ecology. In the spring this species migrates to brooks and smaller streams of moderate to high gradient, clear water, with substrate of gravel, boulders, bedrock, and sand (Trautman 1981). It spawns from late April to mid-June at water temperatures over 16°C. Spawning occurs over gravel (Pflieger 1975, Etnier and Starnes 1993) or over a shallow pit evacuated by the male (Gilbert 1980). The Striped Shiner is a surface, midwater, and bottom feeder and eats aquatic and terrestrial insects, fish, small crayfish, filamentous algae, and detritus (Gilbert 1980, Etnier and Starnes 1993). It moves downstream in winter to larger, deeper waters of lower gradient.

Special Significance or Unique Characteristics. The Striped Shiner, along with the Stonecat and the Sharphead Darter, are three species of special status that, in North Carolina, occur in the Cane River drainage. All major rivers entering Tennessee may have permitted access of this species to North Carolina from Tennessee at one time; dams now block entrance from the Hiwassee, Little Tennessee, and Watauga Rivers. Pollution restricts entry from the Pigeon and, to a lesser extent, from the French Broad, leaving only the Toe with relatively free access.

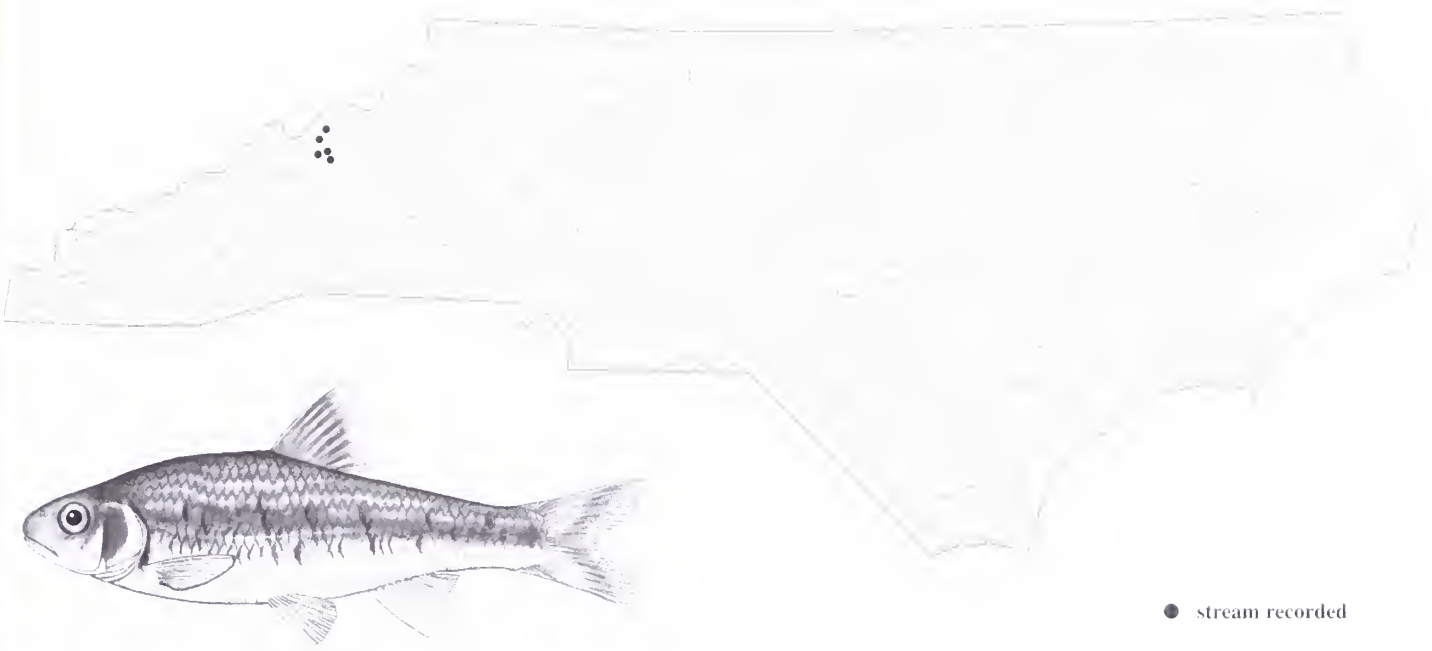
Rationale for Evaluation. Because of its restricted distribution and because of the information that it may provide on the continued well-being of small disjunct populations, the Striped Shiner is assigned Threatened status in North Carolina.

Current Protection. The Striped Shiner is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987.

Recommendations. This is one of four species proposed for special status that occur in the Toe River drainage, indicating a special need to keep streams of this area as pristine as possible. It is recommended that more extensive surveys be undertaken to determine the range of the Striped Shiner more accurately and ultimately to ascertain if changes in range are occurring.

Striped Shiner

Luxilus chrysocephalus (Rafinesque)



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Prepared by Edward F. Menhinick

Logperch

***Percina caprodes* (Rafinesque)**

Status. State Threatened.

Description. The Logperch is a large darter (100 to 165 mm maximum SL) with a pale yellowish ground color traversed by thin, dark, dorsal saddles that extend well down the sides and give a distinctive "tiger stripe" appearance. The 8 to 12 primary saddles (usually darker) extend well below the lateral line, and their lower ends may expand slightly to form small blotches; 7 to 14 intervening secondary saddles extend only to or above the lateral line. Lateral-line scales number 82 to 92 in our area. The dorsal fin has 14 to 16 (12 to 17) spines and 15 to 17 (14 to 18) soft rays. Anal fin soft rays number 9 to 12 (8 to 13). Pectoral fin rays number 14 to 15 (12 to 16). There are 17 principal caudal fin rays. See the *P. bartoni* account for differences from that species. More elaborate descriptions are in Etnier and Starnes (1993) and Page (1983).

Range. The Logperch is widespread and abundant throughout most Mississippi River drainages, the Great Lakes and eastern Canada, and the Atlantic drainages of New York and Maryland. It is peripheral in North Carolina, where it is known to occur in the French Broad River and Spring Creek near the Tennessee border. There is also one record from New River near the Virginia line (UNC-Charlotte). It is also anticipated to occur in the Toe and Watauga systems near the Tennessee border.

Habitat. The Logperch typically occurs in creeks to large rivers. It prefers clear riffles or runs over sand or gravel, or pool areas often near large boulders; it avoids silty areas. This is one of only a very few darter species that is tolerant of reservoirs. Many reservoir and big river populations probably migrate to smaller streams to spawn (Etnier and Starnes 1993).

Life History and Ecology. Spawning occurs over gravel riffles from April through the first half of May. The male mounts the female, and the two fish vibrate into the sand, where 10 to 20 eggs are laid per spawning act; 1,000 to 3,000 eggs are laid per female per year (Winn 1958). Eggs are unguarded and hatch in 7 days. In Illinois total lengths of about 70, 100, and 120 mm were reached at ages 1, 2, and 3, respectively, and 4-year-olds were not seen. Logperch feed on a large variety of aquatic insects and snails, which they often find by flipping over small stones with their snout (Turner 1921, Thomas 1970, Starnes 1977).

Special Significance or Unique Characteristics. Because of the widespread and common occurrence of the Logperch, it is one of the most studied darters, making it potentially valuable as an indicator of environmental quality.

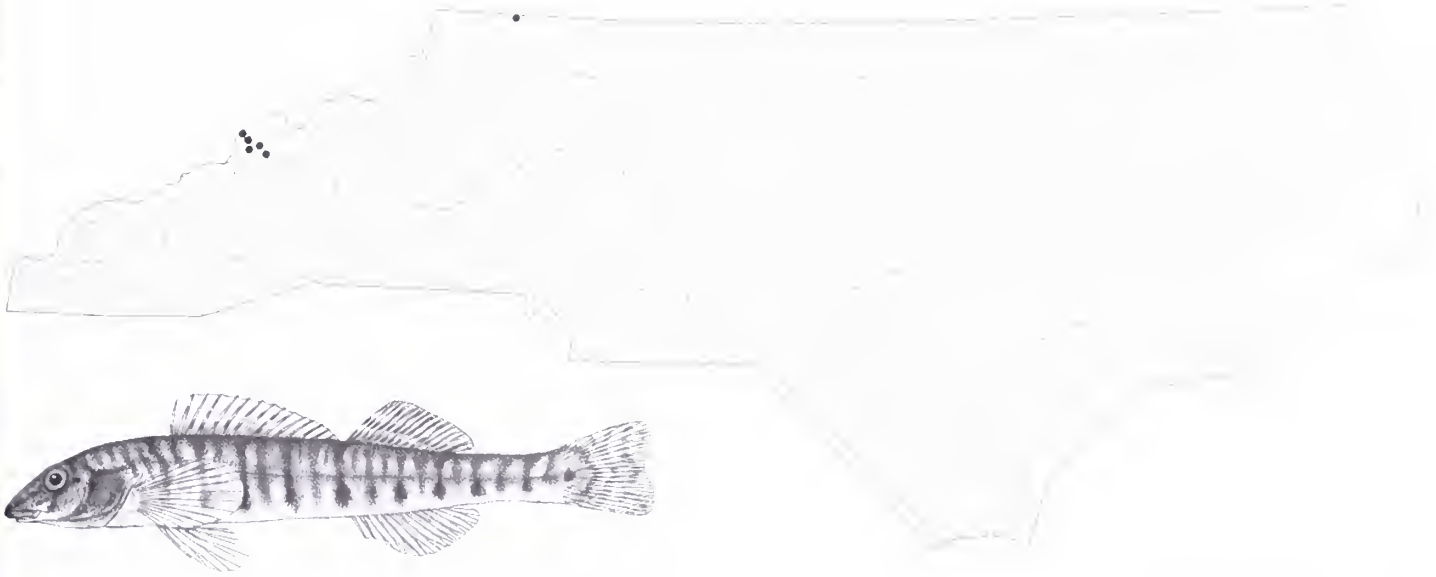
Rationale for Evaluation. The broad distribution of the species elsewhere and the potential for reintroduction, either natural or artificial, supports Threatened status rather than Endangered status that might otherwise be appropriate based solely on the species' North Carolina distribution. More work is needed on the ecology and reproductive biology of the Logperch in North Carolina.

Current Protection. The Logperch is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987.

Recommendations. Monitoring the populations is warranted to watch for changes, and efforts should be made to identify critical habitat for the Logperch. Survey efforts specifically for this species should be conducted in other systems where there is potential for occurrence.

Logperch

Percina caprodes (Rafinesque)



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Prepared by David A. Etnier

Lake Sturgeon

***Acipenser fulvescens* Rafinesque**

Description. The Lake Sturgeon is a mottled sturgeon that has 5 rows of bony plates on the body, a flat triangular snout with 4 large barbels in front of the mouth, and a strongly bilobed tail. It differs from other North Carolina sturgeons in that its yellowish brown to gray body is often mottled with black; there are 25 to 40 gill rakers on the entire first gill arch, and a spiracle is present. Fork length of adults ranges from 750 to 1,200 mm (Gruchy and Parker 1980).

Range, Habitat, and Biology. The Lake Sturgeon occurs in the Mississippi drainages of eastern North America, north to Hudson Bay, and in the St. Lawrence system (Gruchy and Parker 1980). In North Carolina it is known only from a report of 8 sturgeons taken from the French Broad River near Hot Springs in 1945 (Brimley 1946). This bottom-living species occurs in the shoal areas of lakes and large rivers, usually in water 5 to 9 m deep; it infrequently enters brackish water (Gruchy and Parker 1980). It feeds mainly over a clean bottom of sand, gravel, and rocks and avoids soft muddy bottoms (Trautman 1981). It uses its highly protrusive lips to suck up bottom material from which crayfish, clams, snails, insect larvae (especially midges), and fish eggs are selectively removed (Gruchy and Parker 1980). See Trautman (1981), Gruchy and Parker (1980), Scott and Crossman (1973), and Etnier and Starnes (1993) for life history data. Adults may spawn in rocky areas of lakes or may migrate up rivers distances up to 200 km. Spawning occurs from April through June at temperatures of 12 to 18°C. In rivers it spawns in fast water over gravel and may spawn in waters only 1 foot deep (the French Broad River is quite shallow near Hot Springs). Females typically lay 50,000 to 70,000 eggs and spawn only once every 4 to 9 years. The adhesive eggs are scattered over gravel, rocks, and logs, and they hatch in 5 to 8 days. The fish matures in 14 to 20 years and may live 120 years.

Significance, Status, Current Protection, and Recommendations. The Lake Sturgeon has declined over most of its former range because of dams, which prevent entry to satisfactory spawning areas, destruction of spawning areas by siltation and pollution, and overfishing. Its flesh is highly valued as food, and the eggs make excellent caviar. Other than the 1945 Hot Springs record, this species has not been recorded from the state. It was not taken in the 1978 survey of the French Broad River of North Carolina and Tennessee by the Tennessee Valley Authority. However, it apparently still occurs rarely in Douglas Reservoir, the first major reservoir downstream on the French Broad River (Etnier and Starnes 1993). If this is the case, the 64 stream km to Hot Springs is within the species' migration range. The Lake Sturgeon is assigned State Special Concern status and is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987. Efforts should continue to be made to improve waters of the French Broad drainage, and the possibility of restocking should be investigated.

Lake Sturgeon

***Acipenser fulvescens* Rafinesque**

x

✖ extirpated

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Prepared by Edward F. Menhinick

Atlantic Sturgeon

Acipenser oxyrhynchus Mitchill

Status: State Special Concern

Description. Most of this summary was condensed from Ross (1988). The Atlantic Sturgeon is covered with 5 rows of bony plates; the snout is flat and triangular with 4 large barbels in front of the mouth; and the tail is strongly bilobed. It differs from the Shortnose Sturgeon by having 2 longitudinal rows of scales in front of the anus; the length of the barbels is less than 55% of the interorbital width; the viscera are pale; the snout is long in fish under 1,000 mm; the anal rays are 23 to 27; and the fork length of adults in North Carolina is usually 880 to 2,000 mm.

Range, Habitat, and Biology. The east coast subspecies, *A. o. oxyrhynchus* occurs along the Atlantic coast from Labrador to northeastern Florida. The Gulf of Mexico subspecies, *A. o. desotoi*, ranges from the Mississippi delta to Charlotte Harbor, Florida. The Atlantic Sturgeon occurs throughout coastal waters and in most large coastal rivers and estuaries. Some fish probably move south in the fall and north in the spring (Van Den Avyle 1984, Smith 1985).

Atlantic Sturgeon ascend major freshwater rivers of Albemarle Sound and the Pamlico, Neuse, and Cape Fear Rivers during spawning runs beginning in February and peaking in March and April. Spawning occurs in fresh water mostly during April and May. It is not known if Atlantic Sturgeon spawn each year or rest for one or more years between spawnings. Females lay from 100,000 to 2.5 million demersal adhesive eggs on hard or rough bottoms; the eggs are then abandoned by the parents (Scott and Crossman 1973) and hatch in about 7 days. One-year-old sturgeon may reach fork lengths of 200 to 400 mm. They can be 500 to 1,000 mm at 5 years of age, 1,000 to 1,650 mm by age 10, and 1,050 to 1,800 mm by age 15; they usually reach maturity in 7 to 10 years (Murawski and Pacheco 1977, Van Den Avyle 1984). Juveniles generally stay in rivers or estuaries for their first 6 years before migrating into the ocean to mature (Smith 1985; Moser and Ross 1993, 1995). Atlantic Sturgeon live more than 50 years. They forage opportunistically on soft bottoms, feeding upon crustaceans, mollusks, annelids, small fishes, vegetation, aquatic insects, and sediments (Murawski and Pacheco 1977). They may not feed during spawning migrations (Scott and Crossman 1973, Smith 1985).

Significance, Status, Current Protection, and Recommendations. Eggs and flesh of the Atlantic Sturgeon are valued commercially. Most North Carolina catches have been from the Cape Fear River and adjacent ocean, or from the Albemarle Sound area. The Atlantic Sturgeon is assigned State Special Concern status and is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987. Population sizes, ranges, and fisheries have declined rapidly throughout the twentieth century because of degradation of marine and estuarine habitat and spawning areas. Population characteristics, particularly late maturation, possible periodic spawning, restricted spawning sites, and slow growth make Atlantic Sturgeon unusually vulnerable to overfishing and environmental disturbance. As of 1 September 1991 it is illegal to possess any species of sturgeon in North Carolina; this moratorium may be lifted at the discretion of the Division of Marine Fisheries. Sturgeon fishing is also prohibited in Florida, Georgia, South Carolina, and Virginia.

Surveys of abundance, population dynamics, and local migrations in major watersheds are needed; effect of locks, dams, and river flow should also be investigated. Special consideration of water quality and access to spawning areas should be accorded as soon as possible to the Cape Fear River and to western Albemarle Sound. Smith (1985) recommends a complete fishing moratorium throughout the Atlantic Sturgeon's range until its status can be determined.

Atlantic Sturgeon

***Acipenser oxyrhynchus* Mitchill**

● stream recorded

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Prepared by Steve W. Ross

River Carpsucker

Carpiodes carpio **(Rafinesque)**

Status: State Special Concern

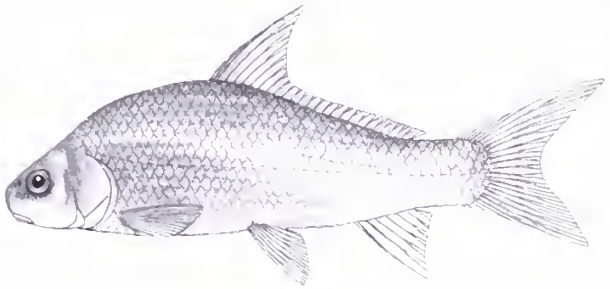
Description. The River Carpsucker is one of several large thick-bodied suckers of the Mississippi drainages with elongated anterior dorsal rays. It differs from other thick-bodied suckers by a combination of the following characteristics: the subopercle is triangular and widest below the middle; the anterior fontanel is open; the lower lip has a small fleshy knob at the tip; the snout is relatively pointed; and the body is unusually elongate (depth into SL varies from 2.7 in young to 3.3 in adults). Coloration is dull gray or brown dorsally and silvery on the sides and ventrally. Adults reach 330 to 636 mm TL (Trautman 1981, Etnier and Starnes 1993).

Range, Habitat, and Biology. The River Carpsucker occurs in the Mississippi-Missouri drainages from Pennsylvania to Montana and in the Gulf of Mexico drainages from Louisiana into northern Mexico (Lee and Platania 1980). There is a single North Carolina record from the main stream of the French Broad River at Hot Springs (Duke University Collection) and a record from the French Broad River in Tennessee near the North Carolina line (Etnier and Starnes 1993). Life history data are from Lee and Platania (1980), Etnier and Starnes (1993), Trautman (1981), and Pflieger (1975). See Jester (1972) for a detailed study of this species. The River Carpsucker occurs (often in large schools) in reservoirs and in deep, quiet, silt-bottomed pools of rivers with low to moderate gradients. It is often found in silty or turbid waters, where it sucks up and swallows bottom material containing filamentous algae and associated periphyton, insect larvae, worms, and mollusks. Individuals migrate upstream to spawn from early May to mid-June at temperatures of 19 to 24°C and return downstream in September. Eggs are broadcast in shallow water over silty sand substrate; 100,000 to 300,000 eggs are spawned per year. Total lengths of fish at the end of years 1 through 4 are about 120, 250, 325, and 370 mm, respectively. The River Carpsucker matures after the second or third year and lives up to 10 years.

Significance, Status, Current Protection, and Recommendations. Although apparently rare in North Carolina, this species' abundance probably has been underestimated because it is mainly collected by netting during spring migrations, an illegal operation in the French Broad River in North Carolina. As a result of this uncertain estimate, its tolerance of silty conditions, and the potential of natural restocking from Tennessee, this species is assigned State Special Concern status, a lower status than its scarcity would indicate. It is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987. Joint studies with Tennessee biologists need to be undertaken, especially during the spring spawning run, to better determine the distribution and abundance of this species.

River Carpsucker

Carpiodes carpio (Rafinesque)



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Trautman, M. B. 1981. The Fishes of Ohio. 2d ed. Ohio State Univ. Press, Columbus.

Prepared by Edward F. Menhinick

Highfin Carpsucker

***Carpiodes velifer* (Rafinesque)**

Status: State Special Concern

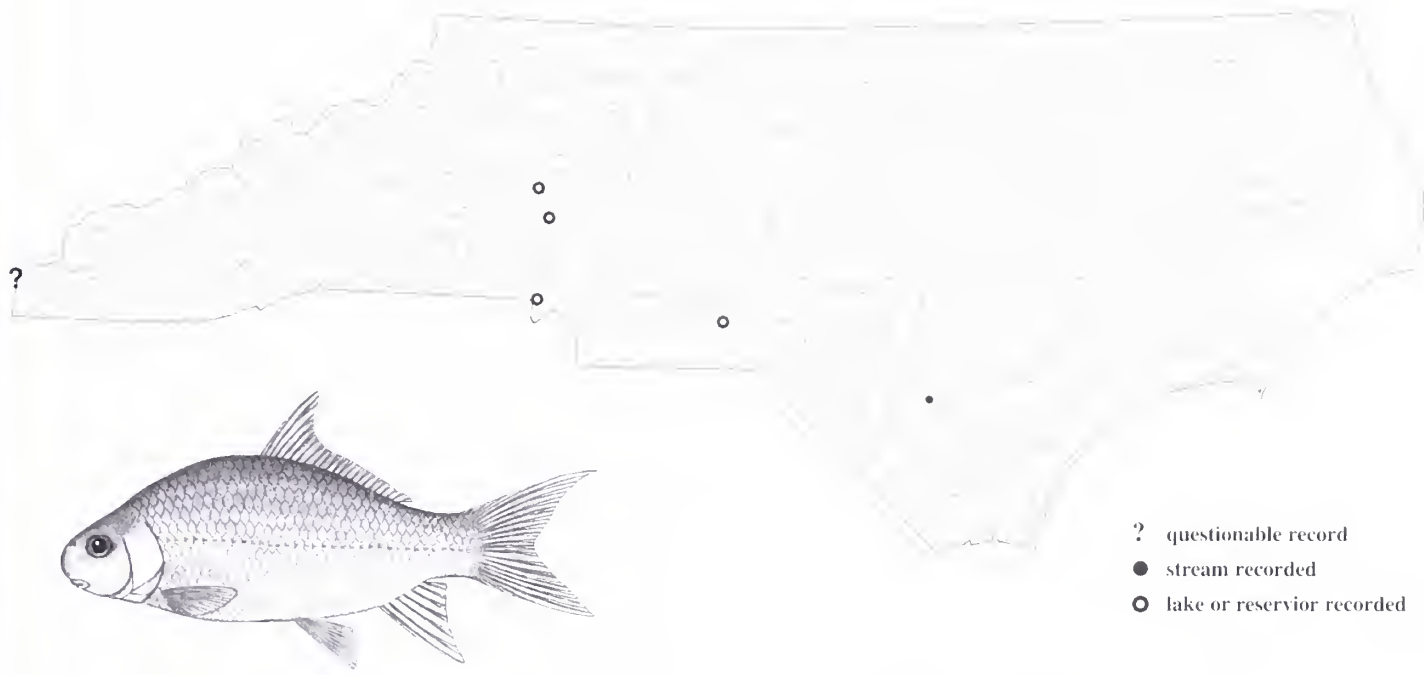
Description. The Atlantic drainage form of this large thick-bodied sucker has only moderately elongated anterior rays on the dorsal fin (as opposed to Mississippi drainage forms that have a high dorsal fin). It can be differentiated from other thick-bodied suckers by a triangular subopercle that is widest below the middle, an open anterior fontanel, and a small fleshy knob at the tip of the lower lip. The tip of the lower jaw is nearly under the anterior nostril (well before it in similar species), and the snout is blunt and rounded. Nuptial tubercles cover the head except for the opercle and cheeks. Body color is dull gray to brown dorsally and silvery on the sides and ventrally; the fins are silvery and are often slightly tannish medially. Adult size is from 225 to 305 mm TL; the largest Atlantic drainage fish the author has examined is 280 mm SL.

Range, Habitat, and Biology. The Highfin Carpsucker occurs in the Mississippi and lower Missouri drainages and in other Gulf of Mexico drainages from the Florida panhandle to Alabama (Lee and Platania 1980). It also occurs in the Piedmont of North Carolina, the only Atlantic drainage records for the country. There is one stream record, and there are several records from reservoirs. The record reported for Lake Appalachia in Cherokee County (Messer 1966) has not been verifed and should be considered questionable. This fish prefers clean water and firm substrate of larger streams and reservoirs and is much less tolerant of siltation and turbidity than other carpsuckers (Pflieger 1975). Although it prefers moderately deep water, the Highfin Carpsucker may also be found in shallow backwater areas. It migrates upstream and spawns in July over deep gravelly riffles (Pflieger 1975). Males predominate in winter and spring in the Apalachicola River, Florida. During the summer and fall females predominate; males may move downstream at that time (Beecher 1977). Total lengths are 22, 29, 31, 33, and 36 cm for the first 5 years, respectively (Carlander 1953).

Significance, Status, Current Protection, and Recommendations. Atlantic drainage forms have shorter anterior dorsal rays and are otherwise distinctive from Mississippi drainage forms; they may represent an undescribed subspecies. The distinctiveness of Atlantic drainage individuals indicates that they may not be introductions; little is known about their distribution, abundance, taxonomy, or biology. This population of the Highfin Carpsucker is assigned State Special Concern status and is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987. Appropriate status surveys and taxonomic work need to be done.

Highfin Carpsucker

Carpiodes velifer (Rafinesque)



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Prepared by Edward F. Menhinick

"Little Tennessee Rosyside Dace"

***Clinostomus funduloides* ssp.**

Status: State Special Concern

Description. The Rosyside Dace is a moderately compressed minnow with small scales. The mouth is large and slightly superior, and there are 48 to 57 lateral-line scales. The lateral stripe is broad and dusky, and adults usually are rosy orange.

Range, Habitat, and Biology. The Little Tennessee River subspecies of *C. funduloides* is an undescribed montane form apparently confined to the Little Tennessee River system in the Great Smoky Mountains and adjacent areas of southeastern Tennessee and southwestern North Carolina. This subspecies occupies sand and rock-bottomed pools and backwaters of cool, clear, swift, shallow streams of small to medium size.

Deubler (1955) reviewed the *C. funduloides* species complex and noted a small contact zone between *C. funduloides* ssp. and *C. f. funduloides* in the extreme headwaters of the Little Tennessee River system and the headwaters of the Savannah River in northeastern Georgia. He further suggested that the Hiwassee River appears to represent a zone of contact between *C. funduloides* ssp. and *C. f. estor*; although this statement was tentative and based on small sample sizes. The taxonomic status of *C. funduloides* and its subspecies is presently under study by B. M. Burr, S. J. Walsh, and E. E. Deubler Jr. A preliminary judgment based on examination of fresh material is that the Little Tennessee River subspecies of *C. funduloides* may warrant full species status. For specific details on the taxonomy and distribution of *C. funduloides* ssp., see Deubler (1955).

Little is known about the basic biology of this unique subspecies. See Breder (1920a,b), Flemer and Woolcott (1966), and Davis (1972) for information on age, growth, food habits, and fecundity of *C. funduloides*. Recent studies on the Little Tennessee River subspecies conducted in Coweeta Creek, North Carolina, have focused on foraging, habitat use, oxygen consumption, home range, and competition (e.g., Hill and Grossman 1987; Facey and Grossman 1990, 1992; Freeman and Grossman 1992).

Significance, Status, Current Protection, and Recommendations. Because of its limited distribution and habitat in Graham, Macon, and Swain (and possibly Cherokee) Counties, North Carolina, this undescribed subspecies is potentially vulnerable to the activities of man (e.g., siltation, clear-cutting, surface mining, agricultural chemical pollutants). Recent (1987) survey work in the upper Little Tennessee River system indicates that this subspecies is rare at localities where it was formerly common. It is assigned State Special Concern status and is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987. Attempts should be made to protect and improve water quality in the upper Little Tennessee River system.

"Little Tennessee Rosyside Dace"

Clinostomus funduloides ssp.

● stream recorded

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Prepared by Brooks M. Burr

Thinlip Chub

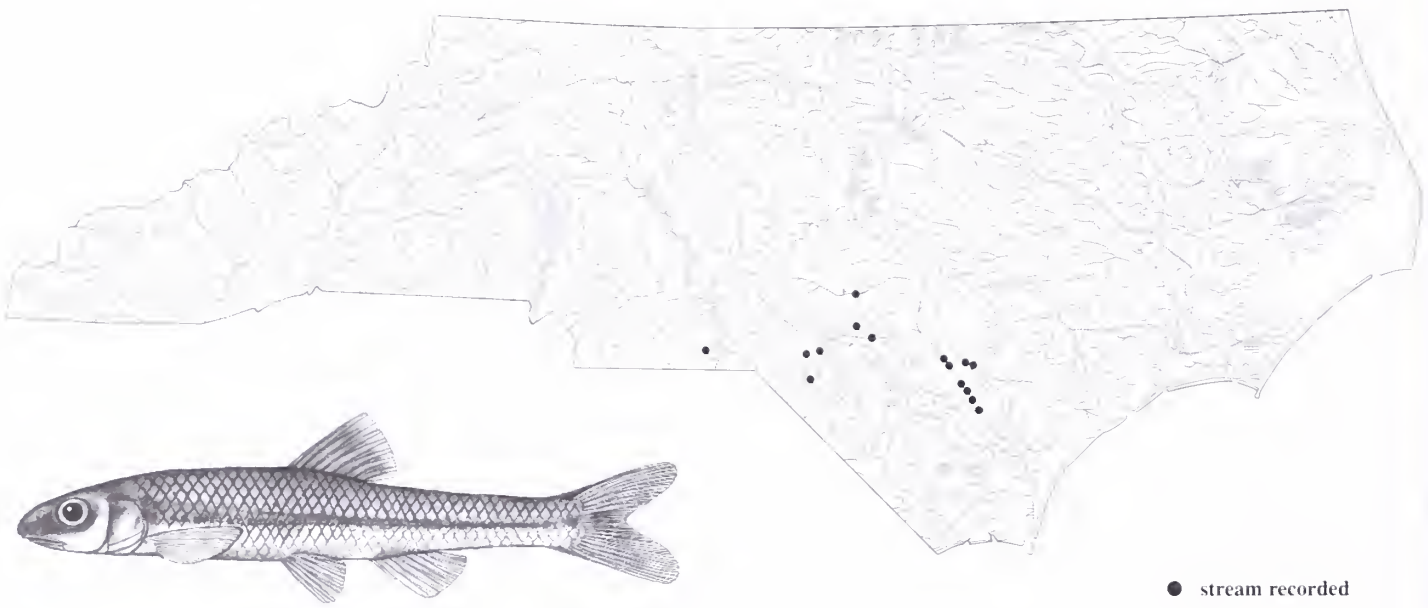
***Cyprinella zanema* (Jordan and Brayton) form**

Status: State Special Concern

Description. This elongate chub may be a form of the Santee Chub, *C. zanema* (Jordan and Brayton) [formerly *Hybopsis zanema* (Jordan and Brayton)] (R. E. Jenkins, pers. comm.). It is characterized by an inferior mouth with short maxillary barbels, an elongate body, a dusky lateral stripe, large eyes, 8 anal rays, 1,4-4,1 pharyngeal teeth, and darkened posterior rays on the dorsal fin. Adults reach 40 to 60 mm SL.

Range, Habitat, and Biology. The Thinlip Chub is endemic to upper Coastal Plain streams of the Cape Fear drainage, the Lumber drainage near Wagram, and the Yadkin in North Carolina, and the Lynches River in South Carolina. It is common in the Black River tributary to the South River in Sampson County (F. C. Rohde, pers. comm.); although once common in the main stream of the South River (Sampson County), it has not been taken there recently (Menhinick 1986). It prefers pool areas of medium-sized streams with moderate velocity, over sandy substrate; it often schools near stumps or other cover. Little is known of its life history and ecology; it probably spawns in early summer (Jenkins and Lachner 1980).

Significance, Status, Current Protection, and Recommendations. This species is important to our understanding of the systematics and biogeography of *Cyprinella.* Because of its restricted distribution, sensitivity to siltation and other forms of environmental degradation, and taxonomic uncertainty, the Thinlip Chub is assigned State Special Concern status. It is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987. Appropriate systematic studies and research on its biology need to be undertaken. There should be an effort to upgrade the water quality of the South River and other streams where it occurs.



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Prepared by Edward F. Menhinick

Carolina Darter

***Etheostoma collis* (Hubbs and Cannon)**

Status: State Special Concern

Description. The Carolina Darter is the only darter in streams of the Piedmont with an arched, incomplete lateral line; there is 1 anal spine. Adults range from 30 to 43 mm SL. Collette (1962) reviews the species and describes the subspecies *E. c. lepidinion*. Hocutt (1980) summarizes the distribution, systematics, and biology. Kuehne and Barbour (1983) and Page (1983) provide accounts of the species along with color photos and distribution maps.

Range, Habitat, and Biology. Two subspecies of *E. collis* occur above the Fall Line in the lower and mid-Piedmont of Virginia, North Carolina, and South Carolina: *E. c. collis* occurs in the Pee Dee and Santee drainages, and *E. c. lepidinion* is found in the Roanoke, Neuse, and possibly the Cape Fear and Tar drainages. Specimens are infrequently taken, and the species is rare throughout most of its range. This fish inhabits backwaters and slack areas near banks of small streams (1.5 to 12 m wide and 0.6 to 1.2 m deep) with sand, mud, or rubble substrate covered by silt or detritus (Collette 1962). It is uncommon in Rocky River (Cabarrus County) and abundant in Crooked Creek (Union County), both of which are heavily silted and located downstream from wastewater treatment plants (E. F. Menhinick, pers. comm.). Biological information is scarce; *E. collis* apparently breeds near the end of March. If similar to *E. fusiforme*, eggs are laid singly on leaves. It lives 1 year. Food consists of fly larvae, amphipods and other small crustaceans, and insect larvae.

Significance, Status, Current Protection, and Recommendations. Etheostoma collis is of special interest and concern because of its rarity, questionable systematics, and lack of natural history information. This fish and its close relative *E. saludae* are probably the most advanced species of the subgenus *Hololepis*. The state of South Carolina lists *E. saludae* as Endangered. State Special Concern status is assigned to the North Carolina populations of *E. collis*, and they are currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987. In light of the current high rate of development and mounting stresses on streams in the Piedmont of North Carolina, a status survey of this species is needed. It may be a species that is disappearing (Kuehne and Barbour 1983).

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Prepared by Alvin L. Braswell

Turquoise Darter

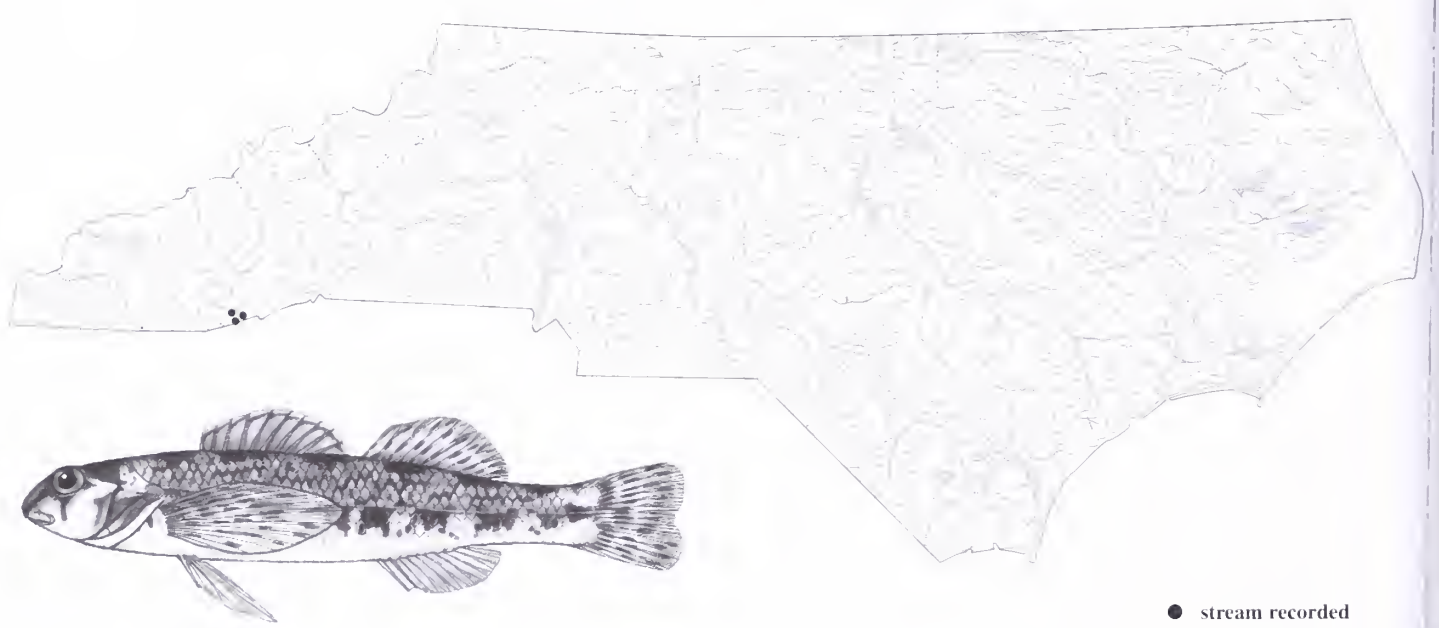
***Etheostoma inscriptum* (Jordan and Brayton)**

Status: State Special Concern

Description. The Turquoise Darter can be separated from its closest relatives in the subgenus *Etheostoma* by a mean lateral-line count of 48 (mean of 42 in *E. thalassinum* and 54 in *E. swannanoa*). It can be differentiated from other Savannah drainage darters by the following characters: 5 to 7 scales below the lateral line, and lateral blotches that do not encircle the caudal peduncle. Adults are 55 to 65 mm SL.

Range, Habitat, and Biology. The Turquoise Darter occurs in the Altamaha, Savannah, and Edisto River systems, typically in the Piedmont and lower Blue Ridge provinces but occasionally in the upper Coastal Plain. In North Carolina it is restricted to lower Horsepasture and Toxaway Rivers of the Savannah River basin. Its preferred habitat is riffle areas over gravel/rubble substrate in moderately swift streams. The headwaters of the Savannah River drainage enter North Carolina in the region of the Nantahala National Forest, an extremely mountainous portion of the state. Here *E. inscriptum* is found below the falls of the Horsepasture and Toxaway Rivers in fast-flowing riffles over cobbles at depths of 10 to 30 cm. This species probably spawns between 25 March and 3 June (Richards 1966). Based on information about other members of the subgenus, its food probably consists of immature aquatic insects gleaned from the bottom.

Significance, Status, Current Protection, and Recommendations. The Horsepasture Gorge is protected to some degree under the Federal Wild and Scenic Rivers Act and the North Carolina Natural and Scenic Rivers Act, but there is still a potential threat to this habitat from the increasing development in the Highlands area. Because the range of *E. inscriptum* in North Carolina is very limited, its habitat is fragile, and Lake Jordan blocks downstream repopulation, this species is assigned State Special Concern status. It is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987. This North Carolina section of the Savannah drainage is also home to two cyprinid species considered in this volume: the Yellowfin Shiner, *Notropis lutipinnis,* and the Rosyface Chub, *Hybopsis rubrifrons.* Menhinick (1986) discusses the status of these species in North Carolina and provides a ranking system for evaluating endangered species. Additional work is needed in this part of the state to determine the status of this and other species.



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Prepared by Peter S. Coleman

Blueside Darter

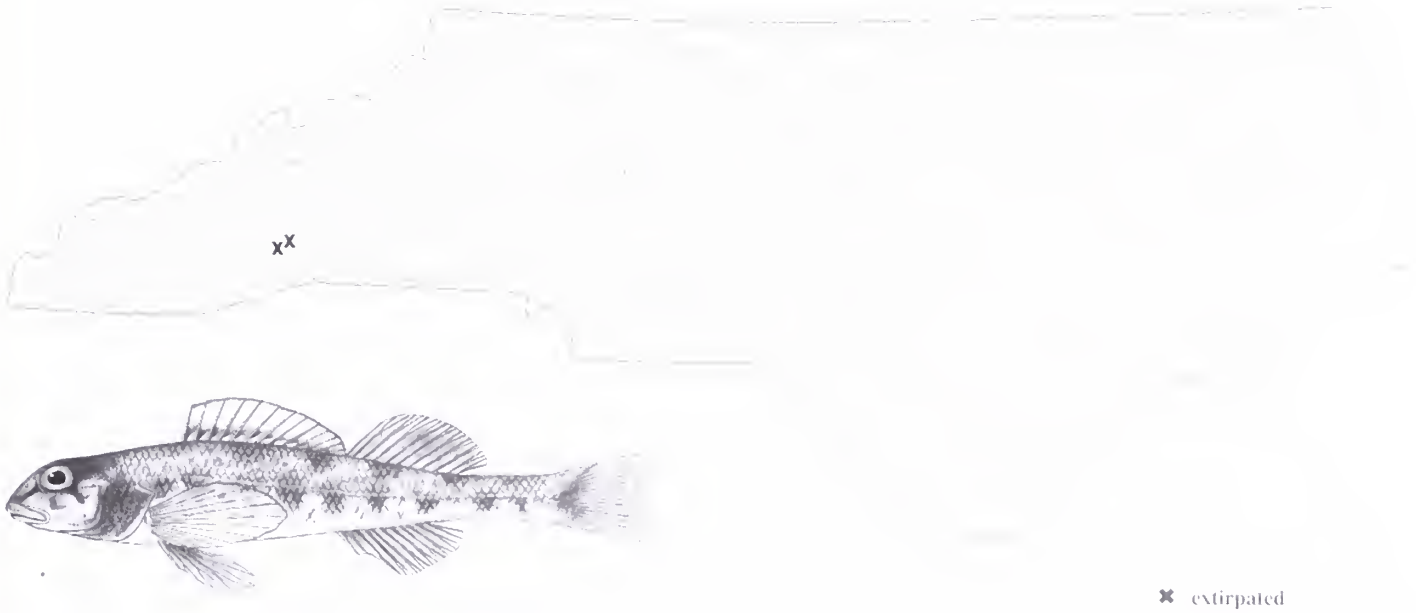
***Etheostoma jessiae* (Jordan and Brayton)**

Status: State Special Concern

Description. The Blueside Darter is characterized by narrowly joined gill membranes, a pointed snout that does not protrude beyond the upper lip, a complete lateral line, sides without longitudinal streaks along each scale row, lateral blotches that do not encircle the caudal peduncle, and a scaled opercle. Males retain some color all year, but they are spectacular during the breeding season, with turquoise blotches on the side and face, turquoise and red bands on the dorsal and anal fins, and orange spots on the caudal and pectoral fins. With an adult size of 34 to 77 mm SL, the Blueside Darter is the largest member of the *E. stigmaeum* complex.

Range, Habitat, and Biology. The taxonomic status of the *E. stigmaeum* complex of the subgenus *Doration* is uncertain; as few as one or as many as five species may be recognized eventually (Etnier and Starnes 1993). The only member of the complex occurring in North Carolina is *E. jessiae,* which is widespread in the Tennessee River drainage of Alabama, Georgia, Tennessee, and Virginia. In North Carolina it is known only from three collections from the West Branch of the Mills River system in Henderson County, where it was last collected in 1950. During most of the year this species inhabits pool areas with sand and detritus substrates, but it moves into shallow gravel riffle areas during the April breeding season. It buries eggs in the gravel.

Significance, Status, Current Protection, and Recommendations. The Blueside Darter apparently has disappeared from a number of areas it formerly occupied, especially in the Holston River system, and it has been shown to be intolerant of habitat alteration (Etnier 1972). The species may be extirpated and is assigned State Special Concern status. It is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987. Efforts should be made to determine if it still occurs in the Mills River system. Adjacent French Broad River tributaries should offer suitable habitat for this species, and it is possible that improvement of water quality in the French Broad River would result in expansion of the species' range in North Carolina.



✖ extirpated

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Prepared by David A. Etnier

Pinewoods Darter

Etheostoma mariae **(Fowler)**

Status: State Special Concern

Description. The Pinewoods Darter is a moderate-sized, fairly robust darter with a rounded caudal fin; adults range from 40 to 63 mm SL. Black spots are present on the cheek, opercle, and breast. The margin of the spinous dorsal fin is clear to white; immediately below is a wide orange-red band. Dark blotches on the sides tend to merge; the dorsum is gold, as is the lateral line. Females are less colorful, shorter, and heavier than males. The branchiostegals are moderately connected. See Kuehne and Barbour (1983) and Page (1983) for more detailed descriptions and for color photographs.

Range, Habitat, and Biology. This species is endemic to streams of the Lumber and Little Pee Dee River drainages just below the Fall Line (Rohde and Arndt 1991). Although one record exists from South Carolina, it may be extirpated from that state. All other records are from the Sandhills region of North Carolina (Richards 1963, Rohde and Ross 1987, Rohde and Arndt 1991). This darter prefers streams with riffles that contain gravel and/or rubble; vegetation is often present. All life history data are from Rohde and Ross (1987). Females are usually twice as abundant as males. Spawning occurs from April to July in water ranging from 14 to 21°C. The shape of the genital papilla and the diameter of mature ova (mean of 1.6 mm) indicate that this species may bury its eggs. Rapid growth permits most individuals to mature at the end of the first year; maximum age appears to be 3 years. Commonly eaten foods are dipteran larvae and other immature insects.

Significance, Status, Current Protection, and Recommendations. Along with the Sandhills Chub, *Semotilus lumbee,* the Pinewoods Darter has a range restricted to the Carolina Sandhills. Few other darters occur in this area. Rohde and Arndt (1991) found the Pinewoods Darter to be extirpated at 8 of the 28 historic localities, while discovering it at 17 new localities. This species was listed in the U.S. Federal Register, Vol. 50, No. 181, p. 37961, 18 September 1985, as being considered for addition to the Federal Threatened Species List. It is assigned State Special Concern status and is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987.

The integrity of the streams in the Carolina Sandhills is threatened by increasing demands by residential, industrial, and military interests. Because of the species' limited distribution, any degradation of the streams of the area could seriously affect this darter's survival. Habitat alteration plans that affect streams in the Sandhills should be reviewed by the appropriate agencies to ensure that these activities will not adversely affect this species. Its status should be monitored periodically.

Pinewoods Darter

Etheostoma mariae (Fowler)

● stream recorded

LITERATURE CITED

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Prepared by Fred C. Rohde

Riverweed Darter

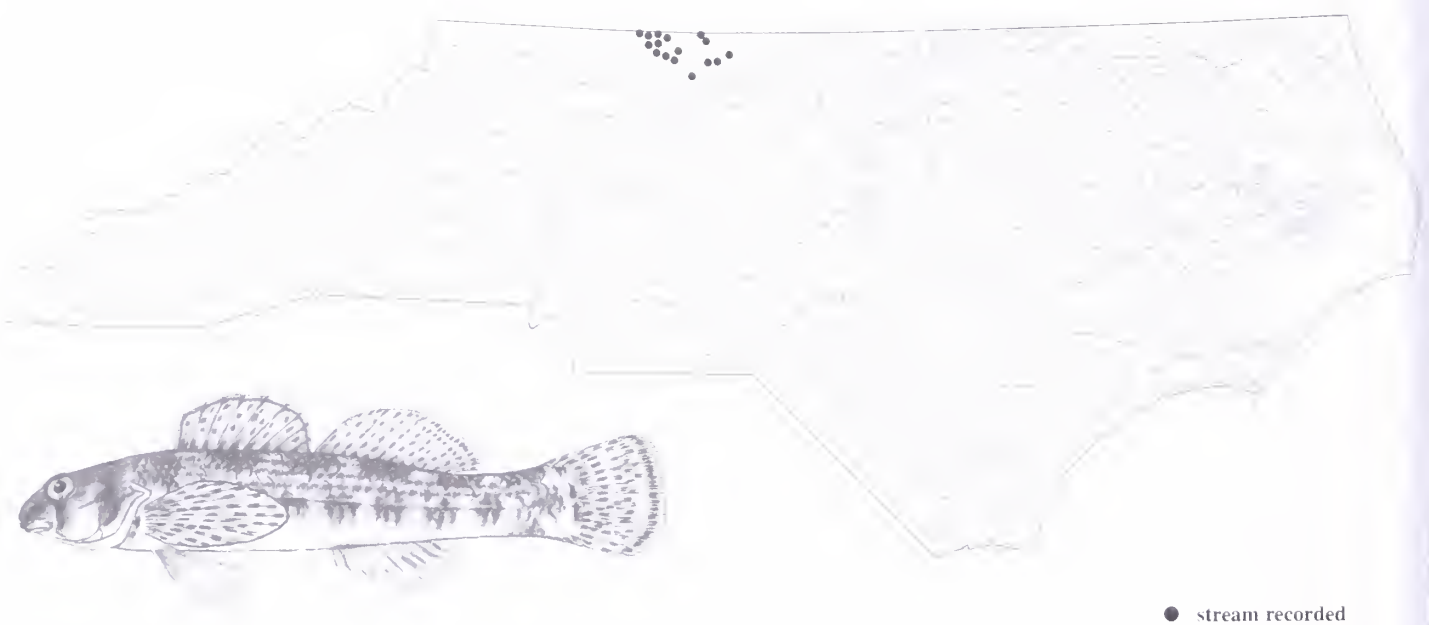
***Etheostoma podostemone* Jordan and Jenkins**

Status: State Special Concern

Description. This large-scaled darter has a complete lateral line of 37 to 39 scales; a dark spot on each scale forms dark lines on the sides that become faint on the dusky underside. Juveniles often have dark W or X markings near the lateral line. The gill membranes are broadly joined, and the caudal fin is rounded (occasionally truncate). Adults vary from 35 to 70 mm SL.

Range, Habitat, and Biology. The Riverweed Darter is endemic to the upper and middle Roanoke drainage of Virginia and North Carolina (Jenkins and Burkhead 1994). In North Carolina it is restricted to the Dan River system, where it occurs commonly in medium-sized streams. It prefers riffles with gravel to cobble substrate of typically clear streams, often associated with riverweed (*Podostemum*, from which it gets its specific name). Kuehne and Barbour (1983) also collected it over predominantly sandy and gravelly riffles with moderate current. The proposed Dan River Dam would have been a serious threat to this species. The Riverweed Darter probably spawns from May to early June. A male leads females to a partially embedded stone. Adhesive eggs are laid on the underside of the stone by several females and are guarded by the territorial male until they hatch. Longevity is up to 4 years (Jenkins and Burkhead 1994). The Riverweed Darter feeds primarily on midge larvae (a diet related to its small mouth opening), although other insect larvae and pupae are also eaten (Matthews et al. 1982).

Significance, Status, Current Protection, and Recommendations. Because this species is restricted to waters of a limited region, the Riverweed Darter is assigned State Special Concern status. It is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987. The Riverweed Darter is apparently intolerant of heavy siltation (Jenkins and Burkhead 1994). The restriction of this species, the Tonguetied Minnow, the Orangefin Madtom, the Bigeye Jumprock, and the Rustyside Sucker to the headwaters of the Dan River indicates the importance of maintaining good stream conditions in the river.



● stream recorded

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Prepared by Edward F. Menhinick

Snubnose Darter

***Etheostoma simoterum* (Cope)**

Status: State Special Concern

Description. This small darter (40 to 60 mm SL) has large fins and a very blunt, rounded snout. The opercle and cheek are at least partially scaled. The body is greenish above and yellowish below, with about 8 or 9 dark green, squarish blotches along each side, which may be confluent or partly so. Small red and yellow dorsal spots are sometimes present. Females and young are less colorful than males. See Kuehne and Barbour (1983) and Page (1983) for more detailed information and for color photos.

Range, Habitat, and Biology. The Snubnose Darter occurs in the upper Tennessee River basin from northern Alabama to southwestern Virginia, and is densely distributed to just short of the North Carolina state line, perhaps in association with the abrupt gradient change at this boundary. In North Carolina there is one early record: Cope (1870) included *E. simoterum* in a list of fishes from the French Broad River in North Carolina; the single specimen that he collected is in the National Museum of Natural History. There are two other questionable records from the region of the lower French Broad River (Etnier 1980, Menhinick 1986); the origin of these records is uncertain (D. A. Etnier and E. F. Menhinick, pers. comm.), and they should be disregarded until any vouchers that may exist are found. The Snubnose Darter occurs in small clear streams with gravel bottom or bedrock strewn with rubble and in larger streams where it prefers shallow gravel riffles (Kuehne and Barbour 1983). *Etheostoma simoterum* breeds in late spring (Etnier 1980). If it is similar to other species in the subgenus *Ulocentra* in Tennessee, spawning probably takes place from late April to early May on rocks in pool areas; males guard the eggs.

Significance, Status, Current Protection, and Recommendations. Although there are no other records of this fish in North Carolina and it is considered extirpated, there is a chance that a peripheral population may be found. It is locally abundant in eastern Tennessee (Kuehne and Barbour 1983). The species is assigned State Special Concern status and is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987. The unusual distribution of the Snubnose Darter (stopping right at the North Carolina border) permits some interesting studies on habitat selection and tolerance. Appropriate streams should be surveyed for this species near the Tennessee state line. Reintroduction into the lower stretches of the French Broad River drainage might be considered if a suitable combination of habitat and water quality can be located.

Snubnose Darter

Etheostoma simoterum (Cope)

✖ extirpated

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Page, L. M. 1983. Handbook of Darters. T. F. H. Publ., Inc., Neptune City, N.J.

Prepared by Alvin L. Braswell

Wounded Darter

***Etheostoma vulneratum* (Cope)**

Status: State Special Concern

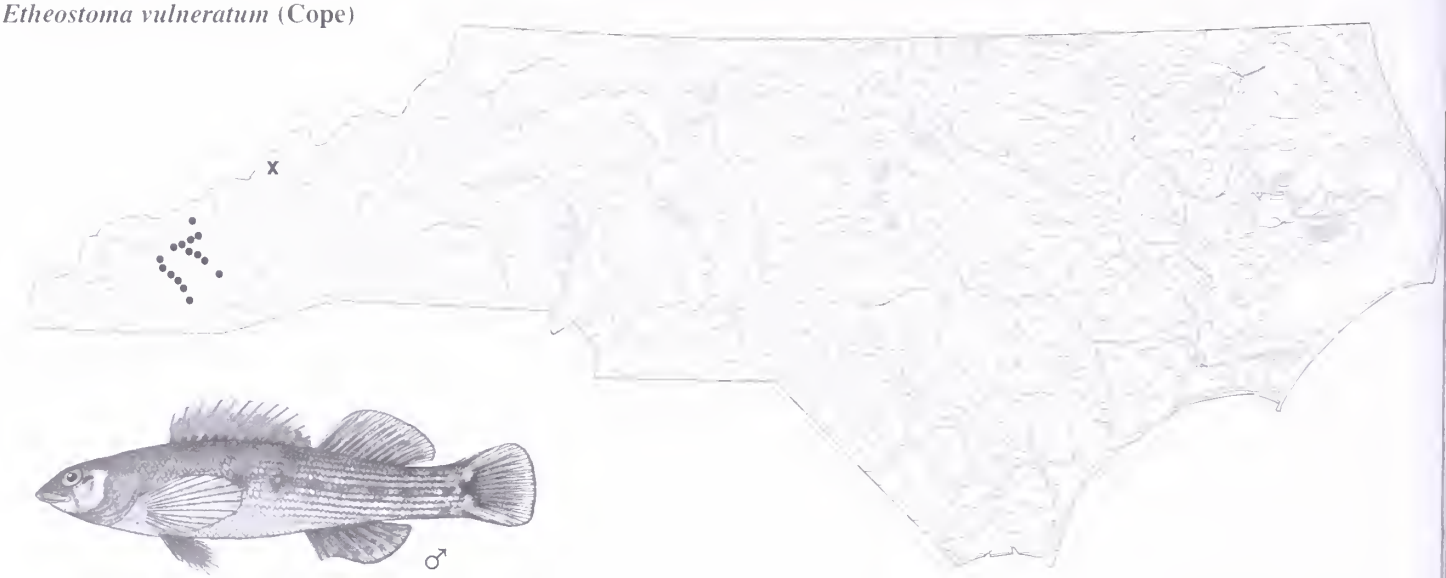
Description. Etnier and Williams (1989) recognized the Wounded Darter as a species rather than as a subspecies of *E. maculatum* and recommended the common name of Wounded Darter. This darter is characterized by a pointed snout, longitudinal stripes along each scale row, cheeks with a few scales behind the eye, nape with no scales, scattered red spots on the sides, and soft dorsal, caudal, and anal fins with a black margin but lacking a pale submarginal band. Adults normally range from 40 to 70 mm SL. Females lack bright colors and have speckled fins (lower figure). Males reach larger sizes (up to 81 mm) than females; they retain their breeding colors of red spots on the sides and a red blotch on the anterior and posterior portions of the spinous dorsal fin all year (upper figure).

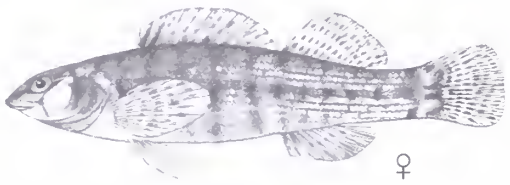
Range, Habitat, and Biology. The Wounded Darter occurs in the Tennessee River drainage above the Hiwassee River. All recent North Carolina records are from the Little Tennessee River system, where it is fairly common. A recent collection (Harned 1979) from the French Broad River in Cocke County, Tennessee, suggests that it may recolonize that area if water conditions improve. This fish occurs in flowing pool areas and strong riffles with cobbles and boulder substrates in small to medium rivers. It spawns from late May to early June at 16 to 20°C in quiet areas near the heads of riffles. Males establish breeding territories under large rocks, where one or several females lay their eggs in a cluster that is then guarded by the male. In Little River, Tennessee, nests contained an average of 48 (17 to 166) eggs (Stiles 1972). Sexual maturity occurs at age 2, and life span is 4 to 5 years. Food is primarily midge larvae.

Significance, Status, Current Protection, and Recommendations. Wounded Darters, like their close relatives in the *E. maculatum* species group, do not occur in small streams and appear to be intolerant of habitat changes. Based on its sensitivity to habitat alterations and reduced range in the state, this species is assigned State Special Concern status. It is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987. The distribution and abundance of this species are well known. Research should center on life history and environmental studies. Reintroduction into the French Broad system might be attempted if pollution is sufficiently reduced there and reinvasion does not occur.

Wounded Darter

Etheostoma vulneratum (Cope)





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Prepared by David A. Etnier

Waccamaw Killifish

***Fundulus waccamensis* Hubbs and Raney**

Status: State Special Concern

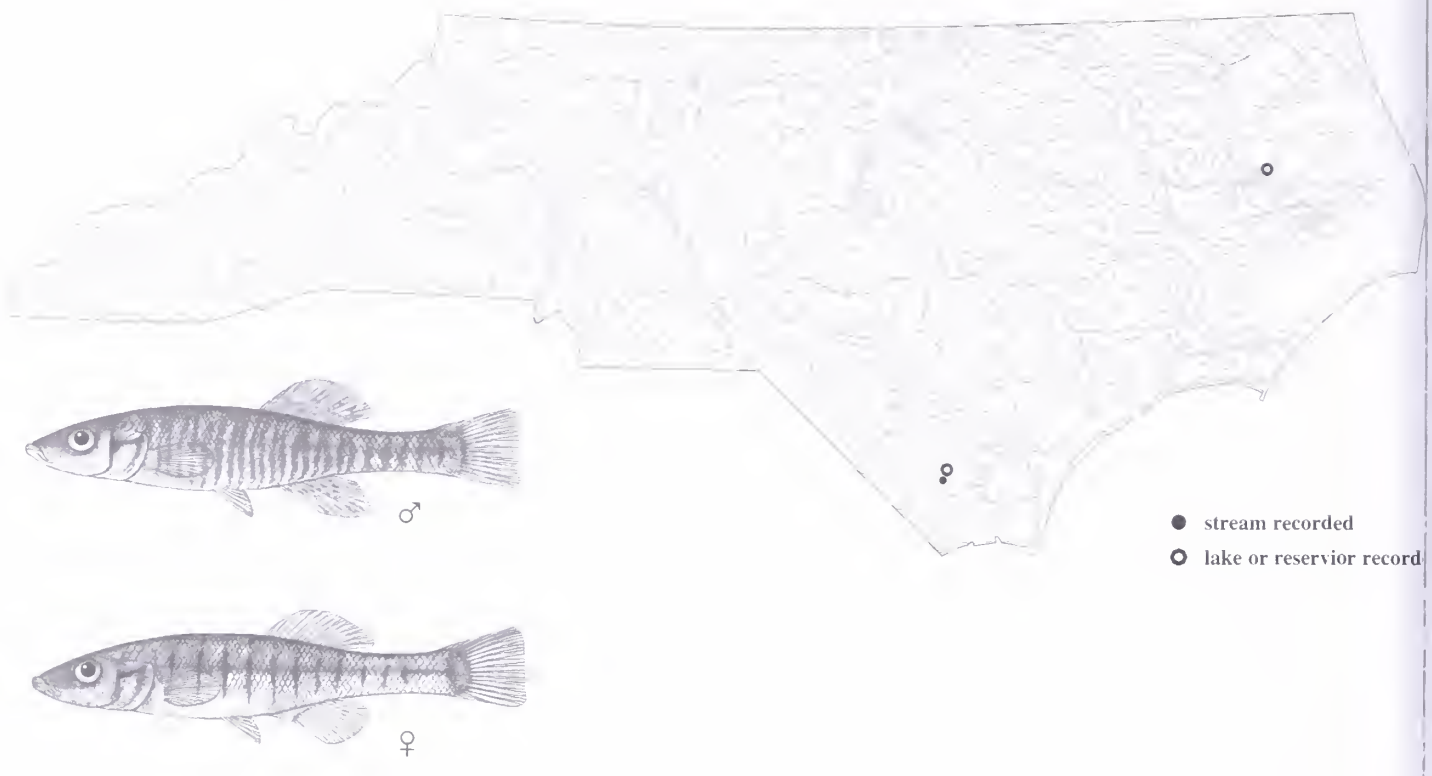
Description. The Waccamaw Killifish is the only killifish normally present in Lake Waccamaw. It can be separated from other killifishes by a combination of the following characteristics: lateral series 52 to 58, gill rakers 4 to 5, males with 15 to 20 dark bars usually wider than light interspaces (upper figure), and females with 12 to 16 narrow dark bars (lower figure). Adults are 45 to 85 mm SL.

Range, Habitat, and Biology. The Waccamaw Killifish is endemic to Lake Waccamaw and its immediate surrounding waters (Shute et al. 1981). Bailey (1977) reported this species in Phelps Lake in northeastern North Carolina; however, these specimens differ morphologically from those found in Lake Waccamaw (Shute et al. 1981; E. F. Menhinick, pers. comm.), which indicates that they are probably not accidental introductions from Lake Waccamaw. This systematic problem is currently under study (R. Cashner, pers. comm.). The Waccamaw Killifish is common throughout Lake Waccamaw and is most often found in association with submerged vegetation in shallow water (Shute et al. 1983). During spawning, which occurs from April through August, males defend territories with lateral displays and spawn with passing females on silty substrate. Adult females contain about 30 to 50 mature eggs (Shute et al. 1983). The Waccamaw Killifish seems to be an opportunistic feeder; it primarily consumes benthic chironomid larvae and amphipods (Lindquist and Yarbrough 1982).

Significance, Status, Current Protection, and Recommendations. Lake Waccamaw is a rather fragile environment and may be in danger of eutrophication (Lindquist and Yarbrough 1982); the Waccamaw Killifish and all endemic or unique organisms occurring in the lake deserve special attention. The species is assigned State Special Concern status and is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987. The shallow littoral zone used as spawning areas by killifish in Lake Phelps is being destroyed by large amounts of wind-blown silt resulting from extensive agriculture in the area; special attention should be given to preventing this problem in Lake Waccamaw. A detailed study including electrophoretic comparisons of this species, the Lake Phelps Killifish, and the Banded Killifish, *Fundulus diaphanus*, is needed.

Waccamaw Killifish

***Fundulus waccamensis* Hubbs and Raney**



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Prepared by J. R. Shute

Least Killifish

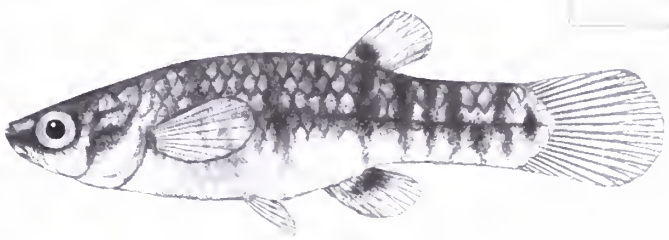
***Heterandria formosa* Agassiz**

Status: State Special Concern

Description. This is the smallest freshwater fish in the state; adults reach only 12 to 30 mm SL. It has 6 to 9 dark bars on the sides, a dark lateral stripe, and a dark spot on the base of the dorsal fin; the female also has a spot on the anal fin. Dorsal background coloration is brown to gray; ventral coloration is light. Most of the head is scaled; the top of the head is flat and unscaled. The lateral line is absent, the mouth opens dorsally, the origin of the dorsal fin is posterior to that of the anal fin, and the anal fin of the male is elongated into a reproductive organ. There are 24 to 28 lateral series scales and no dark subocular bar.

Range, Habitat, and Biology. The Least Killifish occurs in the lower Coastal Plain from southern North Carolina to western Louisiana, including the entire state of Florida (Martin 1980). In North Carolina there are four records from the vicinity of Wilmington, all of which are about 30 km from the nearest population just across the border in South Carolina. The Least Killifish occurs in shallow weedy areas of ponds, roadside ditches, and stream margins; it can tolerate brackish waters. Natural history information is from Reimer (1970), Scrimshaw (1944), and Rhode et al. (1994). A daytime feeder, the Least Killifish gleans the water surface for water fleas, copepods, small insects, other arthropods, snails, rotifers, algae, vascular plants, and detritus. Breeding is from early spring to late summer. Fertilization is internal; up to 8 different-sized embryos may be present at any one time, and females give birth to 1 to 8 young at intervals of about 10 days between broods. Sexual maturity is often reached the first year; maximal life span is 2 years.

Significance, Status, Current Protection, and Recommendations. This is possibly a relict population; its small, isolated distribution could make it valuable biogeographically, and genetically if it is not an introduction. The Least Killifish is assigned State Special Concern status and is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987. Appropriate studies are recommended to ascertain the origin of the population.



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Prepared by Edward F. Menhinick

Mooneye

***Hiodon tergisus* Lesueur**

Status: State Special Concern

Description. The Mooneye resembles shads in that it is a laterally flattened, silvery fish; adipose eyelids are present; and the ventral surface between the pelvic fins and the anal fin is keeled. It differs from shads by the presence of a lateral line; it has prominent teeth on the tongue, the breast lacks a sawtooth margin, and there is no long, posterior filamentous extension of the dorsal fin. Adults reach 450 to 508 mm TL.

Range, Habitat, and Biology. This species ranges throughout larger streams of the Mobile Bay and the Mississippi River basin (except in the upper Missouri) of the eastern United States and occurs from the Great Lakes north to Hudson Bay (Gilbert 1980). In North Carolina, although it previously ranged upstream in the French Broad River into Henderson County, it presently occurs only in a 15-mile stretch of the lower French Broad River from Redmon Dam to the Tennessee border (Menhinick 1986). It occurs in open waters of reservoirs and in medium to large clear rivers, generally in deep swift currents over firm bottom (Smith 1979). It migrates up streams to spawn, probably from April to May in Tennessee (Etnier and Starnes 1993). A female may lay 10,000 to 20,000 eggs per year. It grows 200 mm the first year but requires 6 to 7 years to reach 300 mm (Scott and Crossman 1973, Pflieger 1975). The Mooneye matures in 3 to 5 years and lives up to 8 years. It is primarily a sight feeder, and its large eyes permit it to feed at dusk on surface insects. Small fishes and terrestrial and aquatic insects are preferred; benthic insects, crustaceans, and mollusks are taken to a lesser extent, especially by young fishes (Pflieger 1975, Gilbert 1980). Benthic mayfly, caddisfly, and midge larvae are preferred by young Mooneyes (Glenn 1978).

Significance, Status, Current Protection, and Recommendations. The Mooneye is the only species in the family Hiodontidae in North Carolina. Its susceptibility to turbidity and siltation and to pollution from Brevard has probably been the major cause of its disappearance above Redmon Dam. Because of its susceptibility to pollution and its restricted distribution, the Mooneye is assigned State Special Concern status. This is a lower status than might be expected because of the possibility of recruitment from Tennessee. The Mooneye is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987. Efforts to aid this species in North Carolina should concentrate on improving water quality of the French Broad River.

Mooneye

Hiodon tergisus Lesueur

● stream recorded

✖ extirpated

LITERATURE CITED

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Prepared by Edward F. Menhinick

Least Brook Lamprey

***Lampetra aepyptera* (Abbott)**

Description. Adults of the least brook lamprey have a deeply notched dorsal fin and weakly developed dorsal teeth; myomeres are 63 to 70; adults range in size from 91 to 151 mm TL.

Range, Habitat, and Biology. This species is found in the Atlantic slope from Pennsylvania to North Carolina, west of the Appalachians from Pennsylvania to Alabama and Mississippi, west to Oklahoma and Missouri, and northeast to Ohio and Pennsylvania. In North Carolina there are records from five widely separated streams of the Coastal Plain of the Tar and Neuse River drainages. Rohde et al. (1979) collected at three of these sites and found a few ammocoetes at two of them. Approximately 30 adults were captured in mid-March 1979 at a location in southern Wake County. Lampreys used to be more common in the area (B. Byrd, pers. comm.). When this site was revisited in February 1985, no lampreys were found; in fact, they had not been seen there for several years (B. Byrd, pers. comm.). Several populations were discovered in the upper Tar River drainage in 1992 and 1993 by Division of Environmental Management biologists (V. Schneider, pers. comm.). Adults and larvae lie buried in silty areas along the banks of small, quiet streams with mud substrate. Spawning occurs over sand and gravel. The Least Brook Lamprey is a nonparasitic species, and the adults die after they spawn in early March (spent females were collected at one site in mid-March). The larval period lasts 5 to 6 years, after which they transform to adults over a 5- to 6-week period in late summer.

Status: State Special Concern

Significance, Status, Current Protection, and Recommendations. Based on its severe reduction in dentition, which is extreme among lampreys, *L. aepyptera* is probably the most degenerate (or specialized) of lampreys (Bailey 1980). Analyses of systematics in Vladykov (1982) and Vladykov and Kott (1982) attempt to straighten out the nomenclature of this species but instead add to the confusion. A further taxonomic problem involves the description of certain southeastern populations as *Lethenteron meridionale* (Vladykov, Kott, and Pharand-Coad), a form that Bailey (1980, 1982) and Walsh and Burr (1981) consider a synonym of *L. aepyptera.*

The Least Brook Lamprey is assigned State Special Concern status and is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987. Because of limited distribution, unusual susceptibility to turbidity, and increased development of the Wake County area (with resultant stress on streams), this species is in danger of extirpation in North Carolina. This and the species' taxonomic uncertainty suggest that the Least Brook Lamprey is a future candidate for State Threatened status.

The distribution of this species is poorly known because of its rarity; also, small silted streams are seldom sampled in routine fish surveys, and lampreys are seldom collected with seines or rotenone. A status survey of this species is needed using appropriate collecting techniques (e.g., electrofishing). Streams where known populations occur should be protected.

Least Brook Lamprey

Lampetra aepyptera (Abbott)

● stream recorded

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Prepared by Fred C. Rohde

Bluefin Killifish

***Lucania goodei* Jordan**

Status: State Special Concern

Description. This small killifish has a grayish white body with a black lateral stripe, a scaled head, no lateral line, and a superior mouth; the dorsal fin origin is located anterior to the anal fin origin. The anal fin of females has a reproductive pouch; the dorsal and anal fins of males are bluish with black bases and black margins; the female has clear fins. Adults are 16 to 42 mm SL.

Range, Habitat, and Biology. This attractive little killifish occurs throughout most of Florida and in southern Alabama. Isolated populations occur near the coast in Georgia and in Charleston (Gilbert and Burgess 1980) and Brookgreen Gardens in South Carolina (pers. obs.). In North Carolina it has been reported only from the Burnt Mill Creek drainage in the city limits of Wilmington. The Bluefin Killifish prefers heavily vegetated ponds, drainage ditches, and streams, in areas of little or no current (Burnt Mill Creek is heavily vegetated and has considerable current for a Coastal Plain stream). It tolerates salinities up to 10 ppt. Individuals probably spawn from February to August in North Carolina. Arndt (1971) and Rohde et al. (1994) studied ecology and reproduction. The male sets up a territory and repeatedly raises and lowers his colorful fins to warn other males away and to attract females. Eggs are laid in dense vegetation. Individuals live up to 2 years. Food consists of periphytic plants and animals and sometimes bits of vascular plants. The upturned mouth is used to gulp oxygen-rich surface waters when dissolved oxygen is low (Lewis 1970).

Significance, Status, Current Protection, and Recommendations. The North Carolina population of Bluefin Killifish is considerably isolated from populations in South Carolina; it is either a remnant from a previously wider range or an introduction, or perhaps undiscovered intermediate populations exist (such as the Brookgreen Gardens population discovered in 1993). It is assigned State Special Concern status, a status considerably lower than its restricted distribution would indicate, because it may be an introduction. The species is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987. Biochemical and morphological studies should be undertaken to compare this population with those farther south, and with specimens sold in pet stores, to determine whether it is a relict population or an introduction. A pollution episode in 1994 killed almost all fish and plants in lower Burnt Mill Creek (pers. obs.), but a healthy population remains in an upstream lake (F. C. Rohde, pers. comm.). Special steps should be taken to prevent reoccurrence of pollution of Burnt Mill Creek, which passes through one of the nicer recreational parks in Wilmington, and the Bluefin Killifish should be reintroduced as soon as the creek recovers.

Bluefin Killifish

Lucania goodei Jordan

● stream recorded

○ lake or reservior recorded

LITERATURE CITED

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Prepared by Edward F. Menhinick

Bridle Shiner

***Notropis bifrenatus* (Cope)**

Status: State Special Concern

Description. The Bridle Shiner is an elongate minnow with a dark lateral stripe from the snout to the caudal fin; the lateral line is incomplete; there are 7 anal rays; and the pharyngeal teeth are 4-4. Adults vary in size from 25 to 50 mm SL.

Range, Habitat, and Biology. The Bridle Shiner is found from the St. Lawrence River in southeast Canada south to the Chowan River, Virginia, with disjunct populations in the Neuse River, North Carolina, and Lakes Marion and Moultrie, South Carolina. The Neuse River population is known from one collection from Tucker Creek, Croatan National Forest (Keup and Bayless 1964). This species occurs in warm-water small streams and ponds to large lakes and rivers. It is usually found over mud, silt, or debris in slack-water side areas with moderate to abundant vegetation. Breeding probably occurs in April to May in North Carolina; it spawns in vegetation located in still, quiet water near the shore. Food is small invertebrates and, occasionally, plant material.

Significance, Status, Current Protection, and Recommendations. Bailey and Committee (1977) reported environmental modification of the original collecting site. Tucker Creek is a small coastal stream consisting of a series of deep pools surrounded by heavy underbrush and is unusually difficult to sample. Subsequent attempts to collect this species in North Carolina have failed (Jenkins and Zorach 1970, Rohde et al. 1979). During their survey of the area, Rohde et al. (1979) found salinities had increased from 3.3 ppt (Keup and Bayless 1964) to 8 ppt near the original collecting site. The recent collections of this species from Lake Marion, Santee drainage of South Carolina (pers. obs.) and the identification of uncataloged material in the Charleston Museum collected in the 1950s from Lakes Marion and Moultrie indicate old, established, and possibly native populations in South Carolina.

Notropis bifrenatus is of interest because of the information that disjunct and/or relict populations can contribute to our knowledge of past distribution and evolution of southeastern fish faunas. It is assigned State Special Concern status and is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987. Tucker Creek and other streams with satisfactory habitat in the area need to be resampled to determine if this species still occurs in the Neuse River drainage and whether this disjunct population is native or introduced. Because a major importance of this population lies in its genetic characteristics, no reintroductions should be attempted unless it can be shown to be definitely extirpated.

Bridle Shiner

Notropis bifrenatus (Cope)

LITERATURE CITED

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Prepared by Peter S. Coleman

Yellowfin Shiner

Notropis lutipinnis **(Jordan and Brayton)**

Status: State Special Concern

Description. The Yellowfin Shiner is reddish brown above and light below. It has a dark, wide lateral stripe with no light stripe above it; the fins of breeding males are red in the Savannah and Little Tennessee drainages (an unusual color variant); the lateral line is unpigmented; and the humeral bar is faint. There are 7 to 8 anal rays and 2,4-4,2 pharyngeal teeth. Adults reach 50 to 60 mm SL in North Carolina.

Range, Habitat, and Biology. This species occurs in Atlantic drainages from the Altamaha to the Santee of Georgia, South Carolina, and North Carolina and in the headwaters of the Chattahoochee and Coosa River drainages of Georgia (Gilbert and Burgess 1980). In North Carolina, populations of the "Yellowfin Shiner" from the Broad River drainage are intermediate between *N. lutipinnis* and *N. chlorocephalus* and may represent an undescribed species (Wood and Mayden 1992). The only true Yellowfin Shiners in the state are restricted to the Savannah drainage and to a recently expanding population in the Little Tennessee River drainage of Jackson County. The Yellowfin Shiner occurs in pool areas of small, clear headwater creeks. Little is known about its life history. It probably feeds mainly on aquatic insect larvae. Several dozen brightly colored specimens were collected by the author over a gravel nest in central Georgia on 6 June, indicating a late spring-early summer spawning period.

Significance, Status, Current Protection, and Recommendations. The Savannah-Little Tennessee populations are important for biogeographical studies of the distribution and genetic variability of the subgenus *Hydrophlox* of *Notropis*. Because it is found in only two small areas of the state, both of which are blocked by dams downstream, these populations are assigned State Special Concern status. The species is currently protected under Article 25. "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987. A status survey needs to be made of these populations.

● stream recorded

LITERATURE CITED

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Wood, R. M., and R. L. Mayden. 1992. Systematics, evolution, and biogeography of *Notropis chlorocephalus* and *N. lutipinnis*. Copeia 1992:68–81.

Prepared by Edward F. Menhinick

Mountain Madtom

***Noturus eleutherus* Jordan**

Status: State Special Concern

Description. The Mountain Madtom is a small, weakly mottled catfish attaining a SL of 73 mm. The body is short and stocky, the adipose fin is nearly free posteriorly, a dark blotch in the adipose fin extends only to its basal half, and a midcaudal crescent-shaped blotch is lacking from the caudal fin. There are usually 43 to 49 caudal fin rays, 6 to 8 long recurved serrae on the posterior edge of the pectoral spine, and faint dorsal saddles.

Range, Habitat, and Biology. The Mountain Madtom occurs in the Ohio River basin from western Pennsylvania through Ohio and Kentucky to the Wabash River drainage of Indiana and Illinois and the Cumberland River drainage, Tennessee. It is also found in the Tennessee River drainage of Tennessee, Virginia, North Carolina, and Georgia and in the lower Mississippi River basin, including the Mississippi River mainstem and the Red, Ouachita, White, and St. Francis River drainages of Oklahoma, Arkansas, and Missouri (Taylor 1969, Rohde 1980). In North Carolina there is one record from Spring Creek at Hot Springs, French Broad River drainage in 1889 (Jordan 1890) supported by material studied by Taylor (1969) in the National Museum of Natural History. In 1977 a Mountain Madtom was taken in the French Broad River in Tennessee 15 miles below the North Carolina state line, and it occurs in other nearby streams of Tennessee.

This madtom occurs frequently in, above, and below clean-swept riffles and shoals of clear, large, swift streams and rivers over a cobble, pebble, and gravel bottom. Young-of-year are often found in shallow riffles. It also occurs in big rivers (Ohio and Mississippi Rivers) in swift water around debris piles. A life history study of *N. eleutherus* (Starnes and Starnes 1985) conducted in the Little and Nolichucky Rivers, Tennessee, revealed that the species lives a maximum of 4 years; growth of males and females is similar; males live longer than females and attain greater lengths. The sex ratio is about 1:1. Spawning apparently occurs in June and July. Starnes and Starnes (1985) found one nest on 2 July in water 24°C in a shaded pool 0.7 m deep under an elliptical rock. The nest contained 70 embryos (eggs) guarded by a 66 mm SL male. Mature oocytes ranged from 55 to 115 in 21 females ranging in SL from 41 to 59 mm. This species feeds most intensely after sunset on a variety of aquatic insects; feeding occurs chiefly in riffles.

Significance, Status, Current Protection, and Recommendations. With improved water quality of the French Broad River, the Mountain Madtom could return to North Carolina. Until then, it must be considered extirpated from the state; it is assigned State Special Concern status and is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987. Field survey efforts should concentrate on appropriate habitat in the lower French Broad River and nearby streams to ascertain the present status of this species in North Carolina waters. If not found, reintroductions of the species into streams might be considered. However, reintroduction into the French Broad River probably is not warranted as long as recruitment from downstream reaches is possible.

Mountain Madtom

Noturus eleutherus Jordan

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Prepared by Brooks M. Burr

Carolina Madtom

***Noturus furiosus* Jordan and Meek**

Status: State Special Concern

Description. The Carolina Madtom is the only saddled madtom in the Tar and Neuse drainages. It differs from other North Carolina madtoms by having long recurved serrae on the posterior edge of the pectoral spine and dark dorsal saddles. Adults normally vary from 36 to 84 mm SL.

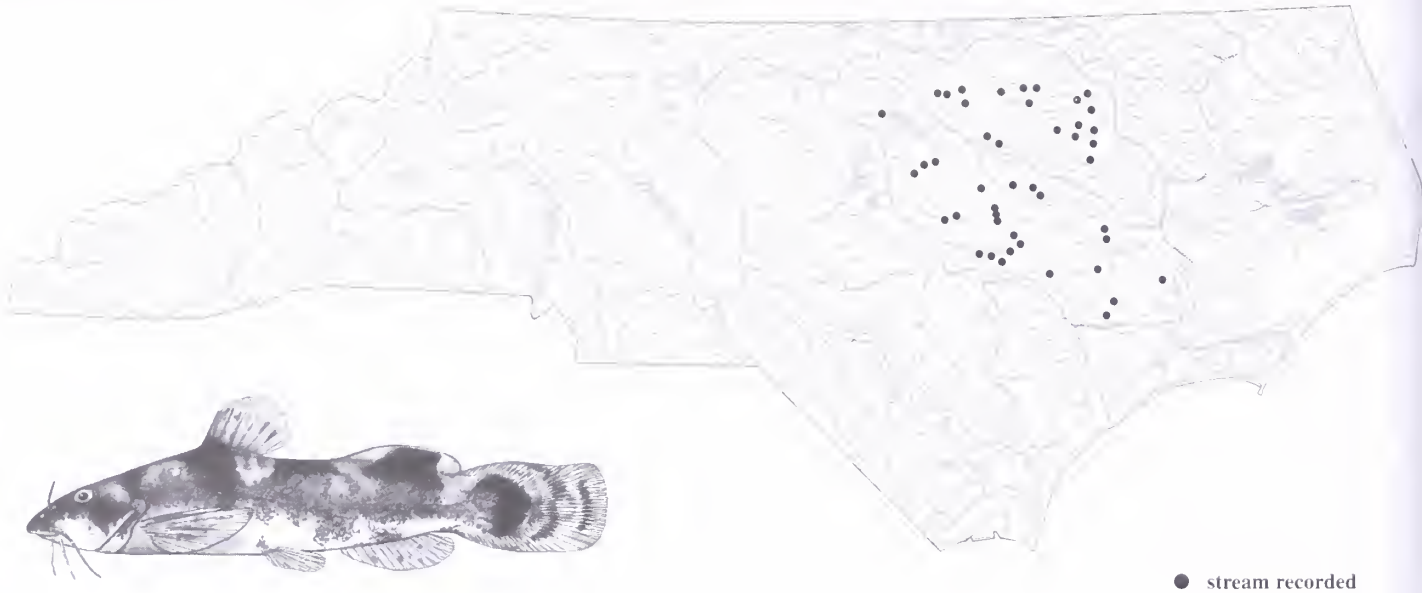
Range, Habitat, and Biology. The Carolina Madtom is endemic to the lower Piedmont and upper Coastal Plain of the Neuse and Tar River drainages of North Carolina. It occurs in medium to large streams over sand, gravel, and detritus substrates. Taylor (1969) thoroughly reviewed the species and noted minimal variation among populations from the Neuse and Tar drainages. Females produce between 79 and 298 mature oocytes per season. Nests with embryos or larvae have been found in May in water 20 to 25°C and were located in cans and bottles in pools or runs. All nests were guarded by males. Both sexes mature at 2 to 3 years of age and live at least 4 years. Adults and juveniles feed upon a variety of benthic organisms, mostly insect larvae or nymphs (Burr et al. 1989).

Significance, Status, Current Protection, and Recommendations. The Carolina Madtom is of special interest and concern because of its endemicity to North Carolina and presumed disappearance from portions of its native historical range. As a result, it was a candidate for prelisting studies by the Office of Endangered Species, U.S. Fish and Wildlife Service. Recent survey work throughout the Neuse and Tar Rivers indicates that *N. furiosus* is reproducing and undergoing recruitment at several localities (Burr et al. 1989). Populations in the Neuse drainage have been affected adversely by the construction of Falls Lake, which has significantly altered water temperatures below the dam. These cool waters and general pollution problems around Raleigh have reduced *N. furiosus* habitat in the upper Neuse River. A toxic chemical spill into the Neuse River near Raleigh on 10 July 1980 caused a massive fish kill, but no *N. furiosus* were found. The Neuse drainage populations are assigned State Special Concern status and are currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987. Conservation efforts should concentrate on improving water quality of the Neuse River.

The Tar drainage populations of *N. furiosus* have experienced fewer cases of severe habitat degradation, and they have no special status assigned to them. However, the Tar River below Rocky Mount to about 20 km downstream shows evidence of extensive municipal and industrial effluents, and *N. furiosus* was not found during a survey of the area (Burr et al. 1989).

Carolina Madtom

Noturus furiosus **Jordan and Meek**



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Prepared by Brooks M. Burr

Broadtail Madtom

***Noturus* sp.**

Status: State Special Concern

Description. Madtoms are small catfishes with a long adipose fin attached posteriorly. This small humped-back madtom of the southeastern Coastal Plain of the Carolinas differs from other North Carolina madtoms by having small serrae present only on the distal part of the pectoral spine; the fins are usually clear with dark streaks near the base; there are 13 to 16 anal rays, and the nasal barbel does not extend beyond the eye. The body is light with dark spots in the river form (upper figure) and uniform gray in the Lake Waccamaw form (lower figure). Adults reach 40 mm SL.

Range, Habitat, and Biology. This species is endemic to North Carolina and to the Lynches River of South Carolina. In North Carolina it is restricted to the South River of the Cape Fear drainage and to Big Swamp Creek and the Lumber River of the Lumber drainage. A distinct population occurs in Lake Waccamaw and the Waccamaw River (Menhinick 1986). During the day the Broadtail Madtom lies partially buried on the bottom of medium-sized streams, in areas about 0.5 m deep with a good flow, generally over gravel or coarse sand, often associated with *Potamogeton* waterweed. In Lake Waccamaw it is most commonly collected near the shore in beer cans and bottles; it prefers sandy vegetated areas (pers. obs.). Little has been published on its life history and ecology. It probably feeds on benthic insect larvae at night. Based upon studies of other Coastal Plain madtoms, the Broadtail Madtom probably spawns in the summer and deposits eggs in clusters under logs or in tin cans and bottles. The eggs are probably guarded by one of the parents. Individuals probably mature in one year and live 2 to 3 years.

Significance, Status, Current Protection, and Recommendations. The Waccamaw population differs from river populations (Menhinick 1991), and thus this species should provide an unusually fine example of variation in madtoms. As it is relatively common in the moderately polluted South River, it is probably not a good environmental indicator. Because of its restricted distribution and taxonomic uncertainty, this small, undescribed species is assigned State Special Concern status. It is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987. Studies of its life history and behavior are needed. Its occurrence in streams affected by increasing developmental pressure calls for special steps to be taken to control pollution in the South and Lumber Rivers.

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Prepared by Edward F. Menhinick

Longhead Darter

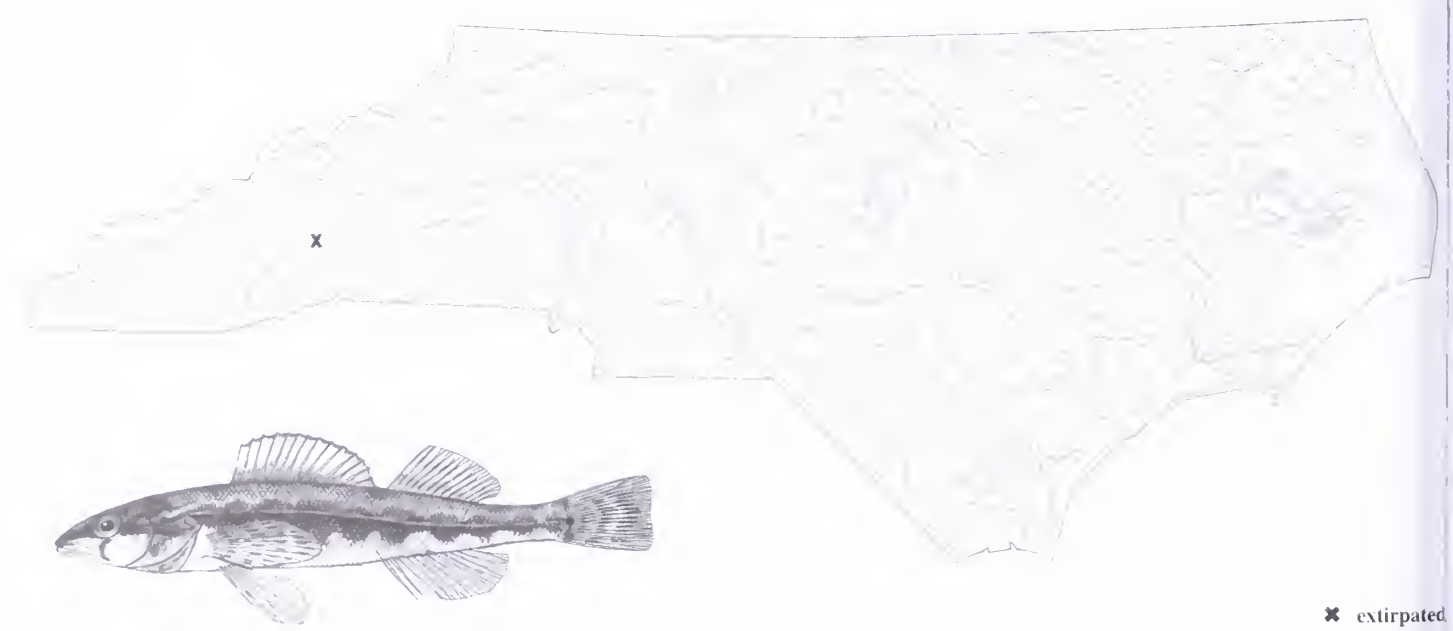
Percina macrocephala (Cope)

Description. The Longhead Darter is an elongate black-lined darter with no markings on the back or dorsal fin; lateral-line scales are 70 to 87. These darters lack bright colors but are handsomely patterned in brown, black, and white. Adults vary from 69 to 102 mm SL.

Range, Habitat, and Biology. The Longhead Darter is a rarely collected species that has a wide range in medium-sized rivers of the Ohio, Cumberland, and Tennessee River drainages. A single North Carolina specimen was taken in the French Broad River near Skyland, Buncombe County, around 1942 (Cornell University 10044) (Bailey and Committee 1977). It occurs in flowing pool habitats, especially above and below riffle areas, often in association with boulders, water willow, or other cover. It is a difficult species to collect with standard seining techniques. Spawning occurs in early spring; during this time adults move onto shallow gravel shoal areas (Etnier and Starnes 1993). Page (1978) found Kentucky specimens to reach 50 to 60 mm SL at age 1, 75 mm at age 2, and greater than 90 mm at age 3; they live up to 4 years. Food is predominately small crayfish and mayfly nymphs.

Significance, Status, Current Protection, and Status: State Special Concern

Recommendations. The Longhead Darter has disappeared from many localities where it formerly occurred, and remaining populations should be monitored periodically. Because no other records of this species have been taken in the French Broad River of North Carolina (even in the extensive efforts of the Tennessee Valley Authority), and water quality in the French Broad River has deteriorated considerably since the original collection was made, the Longhead Darter is undoubtedly extirpated from this drainage in North Carolina. The species is assigned State Special Concern status and is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987. As with many other species extirpated from the state, the Longhead Darter was an inhabitant of the main stream of the French Broad River. Recently the water quality of this river has been improved. Once it is sufficiently restored to permit this species' survival, attempts should be made to reintroduce the Longhead Darter. Based on distribution in Tennessee, the species may also occur in the lower Toe River or the Watauga, and collections should be made there to try to verify its status.



✖ extirpated

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Prepared by David A. Etnier

Sharpnose Darter

***Percina oxyrhynchus* (Hubbs and Raney)**

Status: State Special Concern

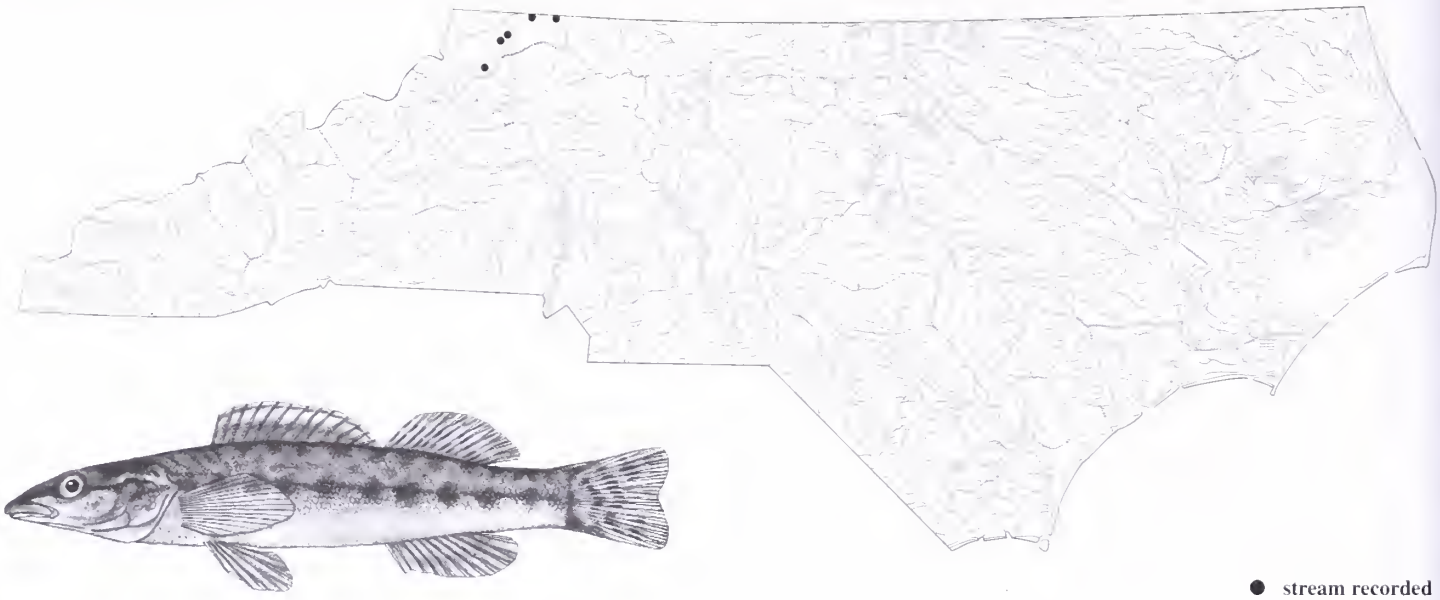
Description. The Sharpnose Darter has a sharply pointed snout and broadly joined gill membranes. The nape, cheek, and opercle are scaled, and the breast is unscaled or with few embedded scales. Adults vary from 70 to 97 mm SL.

Range, Habitat, and Biology. The Sharpnose Darter is indigenous to the Ohio River basin and occurs in southern tributaries to that basin from the Kentucky River drainage in eastern Kentucky to the Monongahela River drainage in western Pennsylvania and West Virginia (Page 1983). In North Carolina the species is known only from the New River and its south fork in Ashe and Alleghany Counties (Thompson 1980, Menhinick 1991). Adults occur in swift currents around large stones and boulders at depths to 1 m; juveniles occupy a variety of habitats ranging from shallow, sandy shoreline areas with slow current to riffles of moderate current underlain by gravel and small rubble. Little biological information is available. Thompson (1977, 1980) infers a late April to possibly early June spawning period as judged from tuberculation and condition of the gonads.

Significance, Status, Current Protection, and Recommendations. Extensive collecting in North Carolina has resulted in fewer than 10 specimens, perhaps in part because of the difficulty of sampling fast, deep riffles. There has been little effort devoted to collecting juveniles. The Sharpnose Darter is reportedly common, but localized, in the New River and its tributaries in adjacent Virginia (Hocutt and Hambrick 1973, Denoncourt et al. 1977). Populations in North Carolina clearly are peripheral and presently are not subject to any apparent threat; however, the continued presence of the species in the New River drainage of Virginia or North Carolina is contingent upon the biological integrity of that system. The Sharpnose Darter is assigned State Special Concern status and is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987. The Wild and Scenic River status of critical parts of the New River offers considerable protection to this species. Special care should be taken to ensure that the river retains its high water quality in this rapidly developing part of the state. Special emphasis should be placed on proper treatment of wastes released into the river and control of siltation both from clearing of land and from agricultural practices.

Sharpnose Darter

Percina oxyrhynchus (Hubbs and Raney)



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Prepared by Melvin L. Warren Jr.

Olive Darter

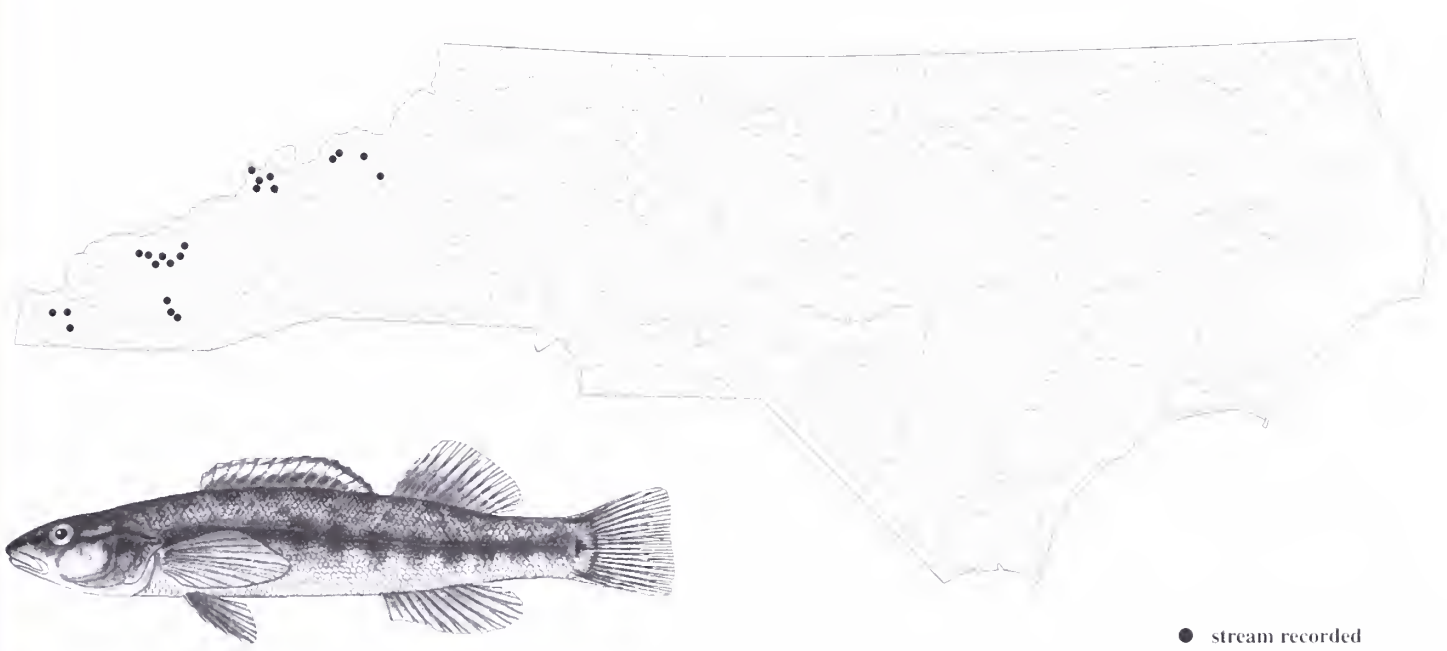
***Percina squamata* (Gilbert and Swain)**

Status: State Special Concern

Description. The Olive Darter is a sharpnose darter with broadly joined gill membranes; the nape, cheeks, and opercles are scaled, and the breast is well scaled. The dorsum is olive gray with indistinct darker saddles; the venter is slightly lighter. Lateral blotches are present in juveniles but fuse as an irregular lateral band that extends from behind the head to a dark caudal spot in adults. The spinous dorsal has a yellow-orange submarginal band. Adults vary from 70 to 108 mm SL.

Range, Habitat, and Biology. This fish occurs in mountain streams of the eastern Tennessee River drainage system of Tennessee, Georgia, and North Carolina; there are isolated populations in the Cumberland River system of Kentucky and Tennessee (Thompson 1980, Page 1983). It occurs sporadically in most Tennessee drainage systems of North Carolina. The Olive Darter is found in deep swift rapids, runs over cobble and boulders, and in deep fast-flowing pools near large boulders (pers. obs.). Etnier and Starnes (1993) review the life history of this species. The Olive Darter feeds largely on caddis fly and mayfly larvae. Spawning probably occurs from mid-May to mid-July. Growth is rapid during the first year (80 mm) and decreases on successive years (year 2, 30 mm; year 3, 35 mm). Maximum life expectancy is 4 years.

Significance, Status, Current Protection, and Recommendations. Based on its extirpation from several streams in North Carolina and its restriction to unpolluted streams, the Olive Darter probably is unusually sensitive to siltation and other pollution. Because of its relative rarity and restriction to larger streams, this species is assigned State Special Concern status. It is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987. A study of its biology in North Carolina is needed. Improving water quality in larger streams would certainly be beneficial.



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Prepared by Edward F. Menhinick

Kanawha Minnow

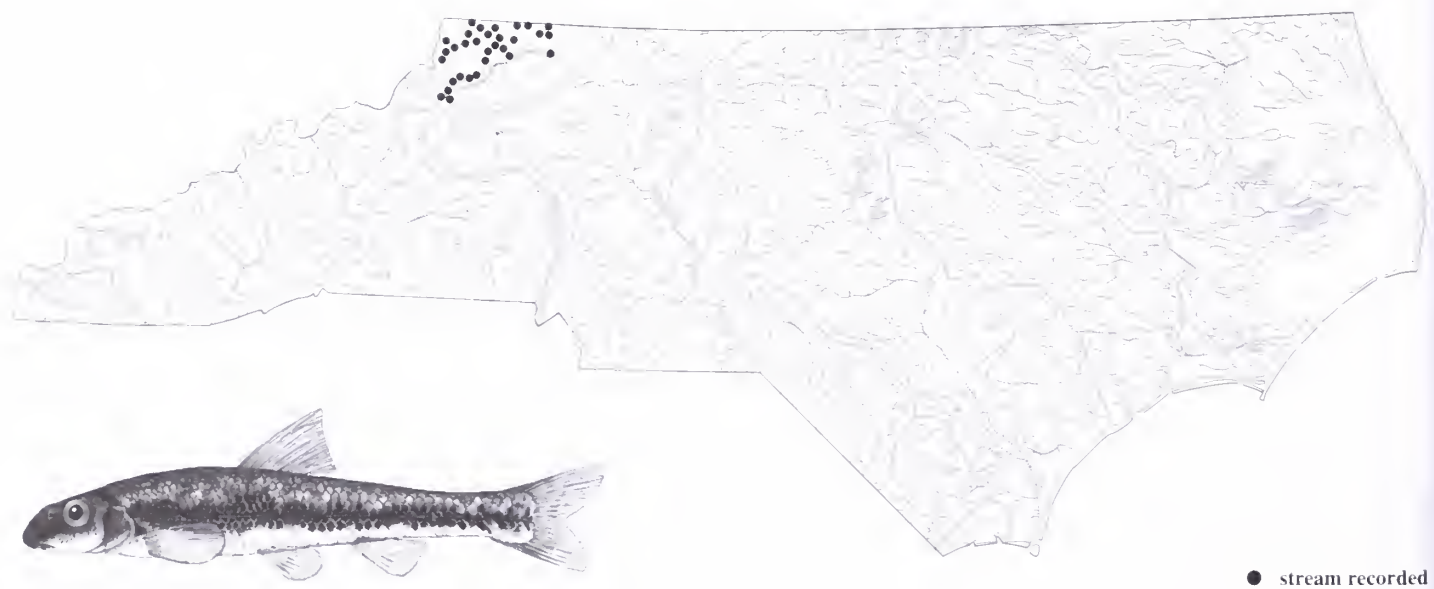
***Phenacobius teretulus* Cope**

Status: State Special Concern

Description. The Kanawha Minnow is a medium-sized cylindrical minnow with sucker-like papillose lips; it has 44 to 49 lateral-line scales. It is dusky above and pale below and has a wide, dark lateral stripe that is iridescent blue in life. Some scales in and above the lateral stripe are darker than others. Adults reach 55 to 85 mm SL.

Range, Habitat, and Biology. This species is endemic to the New River drainage. Most records are from North Carolina and Virginia; it is rare in West Virginia (Jenkins 1980). The Kanawha Minnow is uncommon in cool to warm, medium to large, clear streams, where it prefers riffles and slower runs with substrate of gravel and small rubble. In North Carolina it is widely distributed in medium to large streams. This species spawns from late April to early June and lives up to two years (Jenkins and Burkhead 1994). It is probably a nocturnal or twilight feeder and prefers midge, blackfly, and caddisfly larvae (Hambrick et al. 1975) but also eats other immature benthic insects, tubificid worms, and small snails. The spotted pattern of dorsal scales is associated with regenerated scales that are darker than the original ones (Jenkins and Burkhead 1994).

Significance, Status, Current Protection, and Recommendations. Based on reduction in range in West Virginia and Virginia, this species is unusually sensitive to pollution. This, along with its relative uncommonness in areas where it occurs and its limited distribution in North Carolina, warrants the species' assignment to State Special Concern status. It is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987. Work is needed on the biology of the species. The water quality of the New River and its tributaries must be protected.



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Jenkins, R. E., and N. M. Burkhead. 1994. Freshwater Fishes of Virginia. Amer. Fish. Soc., Bethesda, Md.

Prepared by Edward F. Menhinick

Bigeye Jumprock

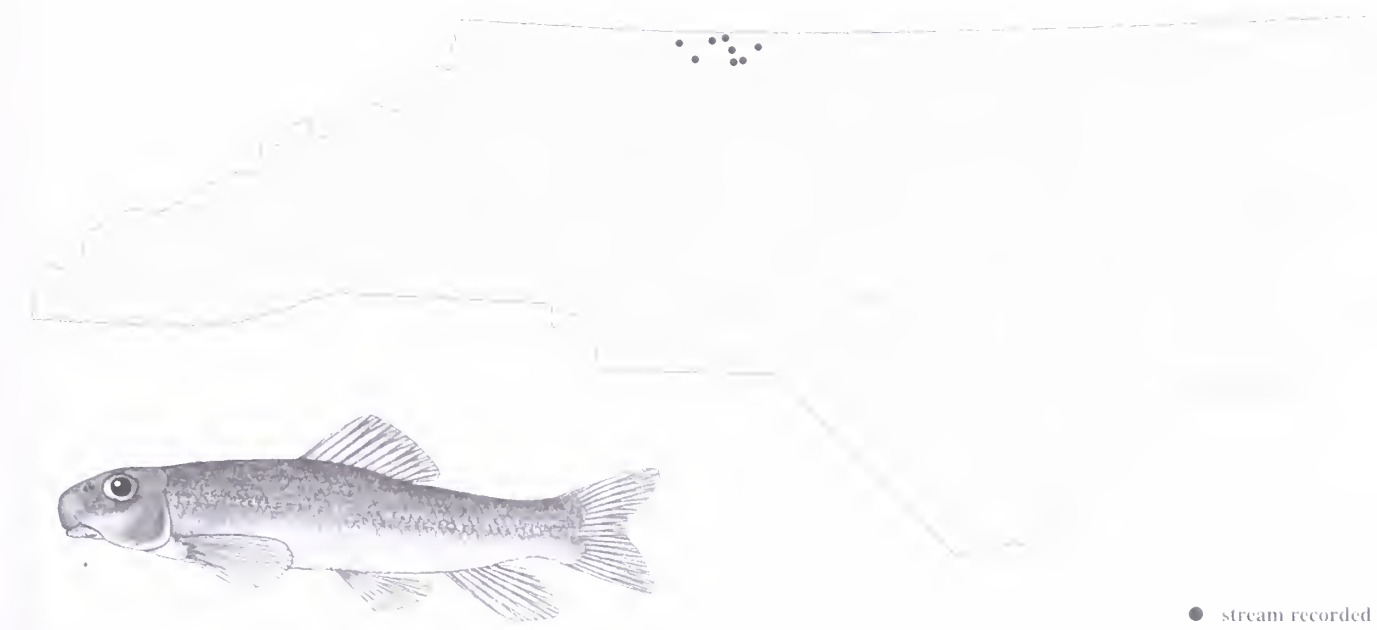
***Scartomyzon ariommus* Robins and Raney**

Status: State Special Concern

Description. This cylindrical sucker has large eyes and a sucker-like mouth with papillose lips; the lower lips are flared posteriorly to form free flaps. There are 15 to 16 caudal peduncle scales and 11 dorsal fin rays. Coloration is dusky gray dorsally (olive gray in life) and pale ventrally. Fins are dusky to slightly reddish. Adults are 110 to 188 mm SL.

Range, Habitat, and Biology. The Bigeye Jumprock is endemic to the upper Roanoke drainage of Virginia and North Carolina, where it is seldom common (Jenkins and Lahrmann 1980). It generally occurs in medium-sized, warm, clear to moderately turbid streams with moderate gradient. Larger juveniles and adults congregate in well-flowing pools and in deep runs, usually among large rubble, boulders, and outcrops where current is reduced; young also occur in shallower slower areas (Jenkins and Lahrmann 1980, Jenkins and Burkhead 1994). In North Carolina the author has collected individuals only from clear, fast-flowing sections of the main stream and tributaries of the Dan and Mayo Rivers. Life history aspects have been studied by Roanoke College students under the direction of Dr. Robert E. Jenkins. It feeds primarily on larval dipterans, mayflies, and caddisflies, and on detritus. Spawning probably occurs in February and early March. The Bigeye Jumprock matures in 3 to 4 years and lives a maximum of 6 to 7 years. The large eye is apparently not used for locating food but rather may be used to detect predators (Jenkins and Burkhead, 1994).

Significance, Status, Current Protection, and Recommendations. The Bigeye Jumprock is "highly divergent from other moxostomatins in several aspects of lip and body form, frequent presence of a 4th gas bladder chamber, retrorse scale margin tubercles, and dark-headed nuptial coloration" (Jenkins and Burkhead 1994). It appears to be unusually sensitive to siltation and is consequently a good indicator of environmental quality. Because of its limited distribution, restriction to large streams, and low density, the Bigeye Jumprock is assigned State Special Concern status; however, State Threatened might be more appropriate. It probably would have been extirpated from the state if the Dan River Dam had been built. The species is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987. Protection of water quality of the Dan and Mayo Rivers is critical.



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Prepared by Edward F. Menhinick

Sandhills Chub

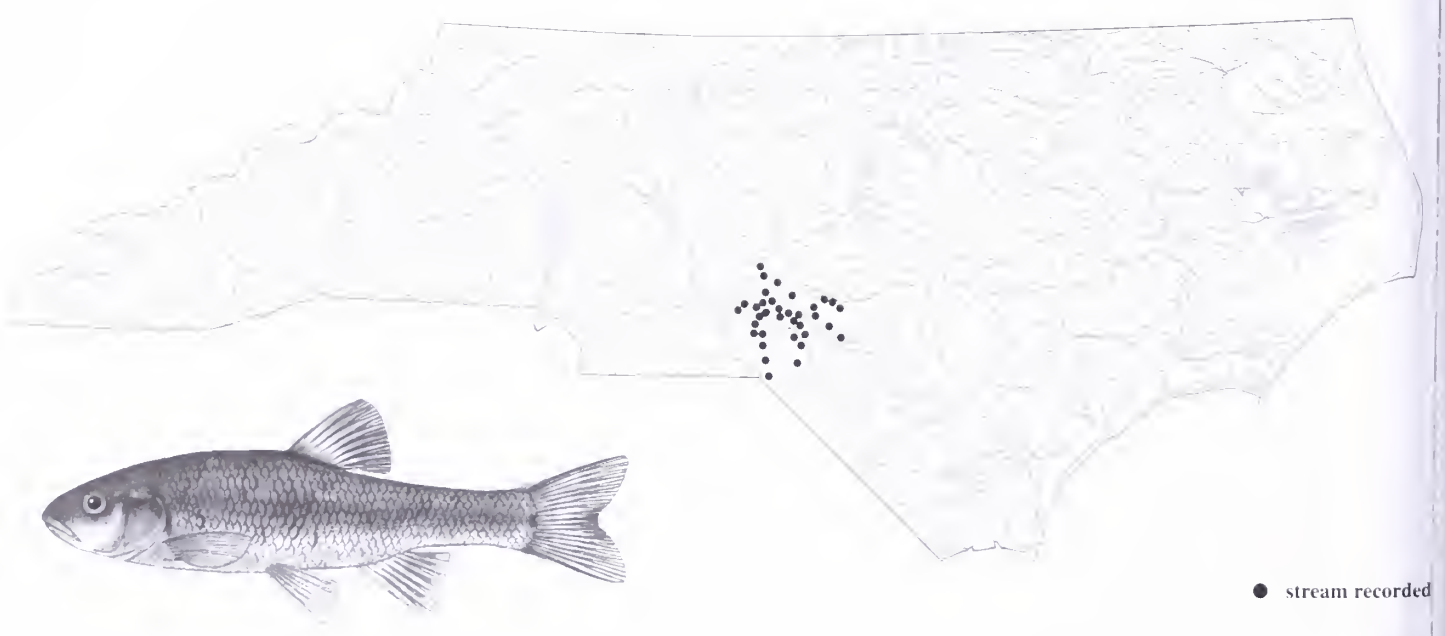
***Semotilus lumbee* Snelson and Suttkus**

Description. The Sandhills Chub is a large, fairly robust cyprinid with a leaf-like barbel. Adults reach 80 to 192 mm SL. It is distinguished from other *Semotilus* species and most North American cyprinids in having 9 (rather than 8) dorsal rays. The anterior basidorsal spot is typically diffuse or absent. Young and juveniles have a broad, dark lateral stripe extending along the body from the caudal base across the head to the snout. In life adults exhibit faint pink or orange in all fins. Tubercles develop on the head, caudal peduncle, and some fins of the male. See Snelson and Suttkus (1978) for a complete description and photograph.

Range, Habitat, and Biology. This fish is restricted to the Sandhills region of south-central North Carolina and north-central South Carolina at or below the Fall Line (Rohde and Arndt 1991). Its center of distribution in North Carolina is the upper Lumber River system (Pee Dee drainage). There are also small populations in adjacent tributaries of the Cape Fear and Pee Dee River drainages. It is rarely sympatric with its close relative, *S. atromaculatus*. The Sandhills Chub prefers small headwater creeks with sand and gravel bottom. Little is published on its life history. The male builds a gravel mound-pit nest similar to that of other *Semotilus* species (Maurakis et al. 1990).

Status: State Special Concern

Significance, Status, Current Protection, and Recommendations. The integrity of the streams in the Carolina Sandhills is threatened by increasing demands made on that area by residential, industrial, and military interests. Any alteration, such as damming for small ponds or degradation of the streams, could seriously affect this cyprinid's survival. Damming of streams by beaver is also detrimental to this species' survival. Rohde and Arndt (1991) found it to be extirpated at 8 of the 22 historic localities while discovering it at 25 new localities. It was listed in the U.S. Federal Register. Vol. 50, No. 181, p. 37961, 18 September 1985, as being considered for addition to the Federal Threatened Species List. The Sandhills Chub is assigned State Special Concern status and is currently protected under Article 25, "Endangered and Threatened Wildlife and Wildlife Species of Concern," added to Chapter 113 of the General Statutes of the State of North Carolina in 1987. Any habitat alteration plans that affect streams in the Sandhills should be reviewed by the appropriate agencies to ensure that these activities will not adversely affect this species. Studies are needed to further define the species' distribution, relative abundance, and reaction to environmental factors.



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Prepared by Fred C. Rohde

Other Species of Interest
Game Fish

Roanoke Bass
***Ambloplites cavifrons* Cope**

Description. The Roanoke Bass differs from the more common Rock Bass in that it has a partly scaled to unscaled cheek, 27 to 35 breast scale rows, and many iridescent gold to white spots on the upper side of the head and body. Adults reach 36 cm TL.

Range, Habitat, and Biology. The taxonomy, distribution, habitat, and aspects of the life history of the Roanoke Bass are largely from Cashner and Jenkins (1980, 1982). The species is indigenous to the Tar and Neuse River drainages of North Carolina and the Roanoke and Chowan River drainages of Virginia. In North Carolina it was first noted and clearly distinguished from its congener *A. rupestris* by Smith (1972). Populations in North Carolina are limited largely to the Piedmont, although Smith noted some unverified angler reports from the Coastal Plain. It was stocked in the Hiwassee system in 1975 and in the upper Cape Fear drainage between 1973 and 1975 by the North Carolina Wildlife Resources Commission (Menhinick 1991). Stocking has been discontinued, but a reproducing population exists in Deep River (Cape Fear Drainage) based on juveniles collected in 1997 (W. C. Starnes, pers. comm.). The species is moderately widespread in both the upper Tar and Neuse drainages but usually is uncommon to rare even in areas known to harbor populations.

Biological information is presented by Smith (1972) and McBride et al. (1980) for North Carolina populations and Petrimoulx (1983, 1984) for Virginia populations. The species matures at age 2 (150 mm SL or 75 to 100 g) and breeds from May through June at water temperatures of 20 to 25°C; spawning takes place over a male-guarded nest, typical of most centrarchids. Crayfish form the predominant adult diet. The Roanoke Bass occurs most frequently in medium to large streams with permanent flow, firm substrates of gravel and fine rubble, abundant boulder and/or bedrock cover, low siltation, and little or no aquatic vegetation.

Significance, Status, and Recommendations. Although not specifically sought by most North Carolina anglers, the Roanoke Bass is considered a challenging gamefish when taken on rod and reel (Smith 1972). Some success in culturing the species in hatchery ponds was attained (Smith 1972), but attempts at transplanting the species in apparently suitable waters of North Carolina (W. B. Smith, pers. comm.) and Virginia (Jenkins and Cashner 1983, Petrimoulx 1983) largely were unsuccessful.

Existing populations in North Carolina are stable and not considered threatened (W. B. Smith, pers. comm.); however, the species has declined in abundance or been extirpated from several stream systems in Virginia, primarily as a result of habitat alteration. In addition, introductions of *A. rupestris* within the Virginia part of the range have resulted in hybridization and displacement of *A. cavifrons* (Jenkins and Cashner 1983). In North Carolina existing populations should be subject to periodic monitoring. Further efforts aimed at establishing additional populations within the native range are encouraged to ensure that this unique sportfish remains a viable component of the North Carolina ichthyofauna.

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Prepared by Melvin L. Warren Jr.

Longear Sunfish

Lepomis megalotis (Rafinesque)

Description. The sides of the Longear Sunfish are colored with orange spots and blue streaks; the black opercular flap is long in adults and margined with white; there are about 4 wavy blue lines on the head; the gill rakers are only slightly longer than their mid-width; the pectoral fins are rounded; and the mouth is small. Adults vary from 41 to 200 mm SL.

Range, Habitat, and Biology. This fish occurs in the Gulf of Mexico drainages (excluding the upper Missouri drainages) of east-central North America from southern Quebec into northern Mexico (Bauer 1980). In North Carolina it was reported in 1940 from Richmond Creek below Lake Junaluska (Pigeon drainage) and in 1934 from the North Fork of the Swannanoa River (French Broad drainage) (Menhinick et al. 1974). There is also a recent unverified report from a pond on the flood plain of the Nottley River southwest of Murphy, Cherokee County, (Hiwassee drainage) (Braswell, pers. comm.).

The Longear Sunfish is found in clear, medium-sized, low gradient streams and upland parts of rivers and along the shorelines of clear water reservoirs (Pflieger 1975, Trautman 1981). It prefers pool areas near logs or brush in silt-free streams with sandy to rocky substrate and is often associated with aquatic vegetation. The Longear Sunfish spawns at a temperature range of 23 to 25°C from mid-May to early August over nests that it fans out in gravelly margins of streams. The male courts the female by displaying his red-orange belly; he guards the nest for a week or more until the eggs hatch and the young leave the nest (Pflieger 1975). Size for years 1 to 6 is 33, 64, 92, 109, 122, and 127 mm TL, respectively (modified from Pflieger 1975). The fish reaches maturity in 2 to 4 years; life expectancy is up to 6 years. The Longear Sunfish feeds on larval insects, crayfish, and occasionally on small fishes, as well as mature insects taken at the surface.

Significance, Status, and Recommendations. This economically important sunfish is unusually sensitive to siltation and turbidity. Because there are no recent records from where it has been recorded previously, it may be extirpated from North Carolina. Original localities should be resampled to determine if relict populations exist; reintroductions should be considered if the original records were not the result of introductions.

LITERATURE CITED

Bauer, B. H. 1980. *Lepomis megalotis* (Rafinesque), Longear Sunfish. Page 600 *in* Atlas of North American Freshwater Fishes, D. S. Lee, C. R. Gilbert, C. H. Hocutt, R. E. Jenkins, D. E. McAllister, and J. R. Stauffer, editors. N.C. State Mus. Nat. Hist., Raleigh.

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Pflieger, W. L. 1975. The Fishes of Missouri. Mo. Dept. Cons., Jefferson City.

Trautman, M. B. 1981. The Fishes of Ohio. 2d ed. Ohio State Univ. Press, Columbus.

Prepared by Edward F. Menhinick

Other Species of Interest
Nongame Fish

Mountain Mullet
***Agonostomus monticola* (Bancroft)**

A single specimen of the Mountain Mullet was collected in 1975 from Royal Oak Swamp Creek, Brunswick County. It is a catadromous marine migrant of sporadic occurrence in subtropical and temperate portions of its range.

Santee Chub
***Cyprinella zanema* (Jordan and Brayton)**

This species has until recently been confused with the Thicklip Chub, *Hybopsis labrosa,* and at the time of Cooper et al. (1977:265–298) its distribution was poorly known. We now have a better understanding of its distribution and ecology.

Fat Sleeper
***Dormitator maculatus* (Bloch)**

Although there are only eight freshwater records of this species from weed-choked streams south of the Neuse River, it is relatively common in brackish waters.

Muskellunge
***Esox masquinongy* Mitchell**

This species is being introduced into a number of reservoirs of the state; these introductions have swamped the gene pool of the "native" muskellunge, and the native muskellunge is no longer regarded as a distinct subspecies.

Kanawha Darter
***Etheostoma kanawhae* (Raney)**

This colorful darter is restricted to the New River drainage, where it remains quite common and is no longer threatened by construction of the New River Dam.

Seagreen Darter
***Etheostoma thalassinum* (Jordan and Brayton)**

This species occurs commonly over a wide area in upper Piedmont and mountain streams of the Catawba and Broad River drainages.

Tonguetied Minnow
***Exoglossum laurae* (Hubbs)**

This unusual minnow occurs in most larger streams of the New River drainage. The New River Dam, which would have destroyed most sites, will not be built.

Roanoke Hog Sucker
***Hypentelium roanokense* Raney and Lachner**

Healthy populations of this species occur in the Dan and upper Roanoke Rivers of North Carolina, and dams tentatively proposed by the Corps of Engineers will not be built on these rivers.

Bigmouth Buffalo
***Ictiobus cyprinellus* (Valenciennes)**

This species, which occurs in Lake Wylie and possibly in Lake Tillery, is probably an introduction.

Redeye Bass
***Micropterus coosae* Hubbs and Bailey**

Native populations occur below the falls in Toxaway and Horsepasture Rivers of the Savannah drainage and the species has been stocked in several other drainages.

Bluehead Chub subspecies
***Nocomis leptocephalus interocularis* Lachner and Wiley**

The subspecies *N. l. bellicus* was assigned to the "Special Concern" category by Bailey and Committee (in Cooper et al. 1977) because it was restricted to the Savannah drainage. Because the Savannah drainage population of *N. leptocephalus* is now assigned to *N. l. interocularis,* a subspecies that is common in the Savannah drainage, it is not assigned status in North Carolina.

Bigmouth Chub
***Nocomis platyrhynchus* Lachner and Jenkins**

The Bigmouth Chub (perhaps a subspecies of *Nocomis micropogon,* the River Chub) is restricted to larger streams of the New River drainage. It is no longer under threat by the New River Dam and is relatively common in the drainage.

New River Shiner
***Notropis scabriceps* (Cope)**

This species is abundant in the New River drainage, which is no longer threatened by the New River Dam.

Tangerine Darter
***Percina aurantiaca* (Cope)**

This large, colorful darter occurs rarely in large streams of all Tennessee River drainage basins and in Fontana Lake. Its occurrence is known over a wide range.

Bluntnose Minnow
***Pimephales notatus* (Rafinesque)**

This species is no longer threatened by the New River Dam, and populations have been discovered in the Toe River drainage near Burnsville.

LITERATURE CITED

Cooper, J. E., S. S. Robinson, and J. B. Funderburg, Jr. (editors). 1977. Endangered and Threatened Plants and Animals of North Carolina. N.C. State Mus. Nat. Hist., Raleigh.

Prepared by Alvin L. Braswell

Addenda

Since the preparation of accounts and materials for review during the 1985 reevaluation process, two additional species, whose conservation status is of considerable concern, have been identified for evaluation for legal protection. Detailed accounts for these species follow.

"Robust Redhorse"

***Moxostoma robustum* (Cope)**

Nomenclature. The scientific name of this recently rediscovered species, described from Yadkin River, North Carolina, by Cope (1870), was misapplied by Robins and Raney (1956) to a still undescribed species in the genus *Scartomyzon*. (During 1956–1993 the jumprock sucker was erroneously called the Smallfin Redhorse, *Moxostoma robustum*.) The true Robust Redhorse had been regarded as a form of the River Redhorse, *Moxostoma carinatum*, but the two species are now known to be distinct.

Description. The "Robust Redhorse" is a large, wide-bodied sucker reaching 720 mm TL and 8 kg. It has a stout pharyngeal arch and molariform teeth; the head is medium to large; lips are medium to large and fully plicate; the posterior margin of the lower lip is very slightly concave or straight, or posteriorly prolonged (flaplike) medially; and the dorsal fin margin is slightly concave or straight. In breeding males the snout, cheek, opercle, underside of head, and anal and caudal fins are heavily tuberculate. It has (11)12 circumpeduncle scales, (28)29 to 31(32) circumbody scales, (40)41 to 44(45) lateral-line scales, 12 to 14 dorsal rays, and (9-9)10-10 pelvic rays. The body usually has a golden brown tone and brassy to coppery sheen; scale bases are dark olive to black; lower fins are typically orange; the caudal fin is partly red; and the dorsal fin is olive, sometimes partly red.

Range. The only known viable population is in Oconee River, Georgia. It is known from Savannah River, Georgia and South Carolina, in 1980 and 1982. In North Carolina it has been taken in the Catawba River (1869), Yadkin River (1869), Rocky River (ca. 1968), and Pee Dee River (1985); skeletal parts have been found near Yadkin River and Hunting Creek at sites of former Native American inhabitation.

Habitat. This species occurs in medium to large, warm rivers of the Piedmont and upper Coastal Plain. In Oconee River it is associated with moderate to swift current, shallow to deep, gravel bottom and snags. Individuals likely prosper in both mostly rocky and mostly sandy rivers, with sufficient food and gravel for spawning.

Life History and Ecology. The "Robust Redhorse" spawns on gravel in May in Georgia. Individuals mature at an unknown age after age 4 and when larger than 500 mm TL; maximum known longevity is 25 years. It eats insect larvae, small crustaceans, mollusks (crushing them), and probably other invertebrates; it feeds heavily on the Asian Clam, *Corbicula*.

Special Significance or Unique Characteristics. The "Robust Redhorse" was a food fish when formerly common in Pee Dee River. The species represents a large piscine symbol of how poorly known are some aspects of large rivers and how much they have lost.

Status. None; this species is under evaluation for Federally Endangered status.

Rationale for Evaluation. All populations have declined, and perhaps all except the Oconee River population are extirpated.

Current Protection. None.

Recommendations. The Pee Dee, Catawba, and Broad Rivers and their largest tributaries should be searched for populations. No more than moderate water releases from dams should be allowed during the spawning season. Populations of blue and flathead catfishes, both major predators of suckers, in these rivers (to which they are not native) should be greatly reduced.

LITERATURE CITED

Robins, C. R., and E. C. Raney. 1956. Studies of the catostomid fishes of the genus *Moxostoma* with descriptions of two new species. Cornell Univ. Agric. Expt. Sta. Mem. 343.

Prepared by Robert E. Jenkins and Byron J. Freeman

"Sicklefin Redhorse"

***Moxostoma* sp.**

Taxonomy. The "Sicklefin Redhorse" was first recognized as an undescribed species in 1992. It had been misidentified as *M. macrolepidotum* and *M. carinatum* and depicted (inaccurately for the dorsal fin) as *M. carinatum* by Menhinick (1991).

Description. This is a medium-sized, elongate, somewhat compressed sucker reaching 550 mm TL and 1.5 kg. It has a moderate pharyngeal arch and slightly molariform teeth; the head is moderate; the snout is well rounded, often somewhat bulbous in adults; lips are moderate and basically plicate, but the lower lip has many branched and transected plicae; the upper lip is often much thicker medially than laterally; and the posterior margin of the lower lip is straight or very nearly so. The dorsal fin is highly falcate; when depressed, rays 1 to 3 usually extend much posterior beyond the tip of the last ray. Breeding males have tubercles obvious only on anal and caudal fins. It has 12(13) circumpeduncle scales, 32 to 35 circumbody scales, 43 to 46(47) lateral-line scales, 12 to 14 dorsal rays, and 9-9 to 10-10 pelvic rays. The body has an olive tone and brassy to coppery sheen; scale bases are olive to black; lower fins are yellow or orange, pale-edged; the caudal fin is mostly red; and the dorsal fin is olive, sometimes partly red.

Range. The "Sicklefin Redhorse" occurs in the Hiwassee and Little Tennessee River systems of the Tennessee River drainage of Georgia (Brasstown Creek) and North Carolina. It is known in the Hiwassee River system from Hiwassee Reservoir, Hanging Dog Creek, Valley River, and Brasstown Creek and in the Hiwassee River between Hiwassee Reservoir and Mission Dam. In the Little Tennessee system it is known from Fontana Reservoir, Little Tennessee River (Fontana Reservoir to Iotla), Burningtown Creek, Iotla Creek (lowermost), and Tuckaseegee River (Bryson City area).

Habitat. This species frequents cool and warm, medium creeks to medium rivers in the Blue Ridge province. It occurs mainly in runs and riffles in gravelly and rocky reaches.

Life History and Ecology. The "Sicklefin Redhorse" spawns in April and/or May. Longevity is at least 13 years. It feeds in fast water and pools, sometimes foraging on sticks above bottom.

Special Significance or Unique Characteristics. This species is restricted to a small area, almost entirely in North Carolina. One of the most distinctive of redhorses, surprisingly it had long been unidentified.

Status. None; this species remains under study.

Rationale for Evaluation. This species has a limited range. The proposed widening of North Carolina Route 28 along Little Tennessee River, mine effluents in Macon and Swain Counties, and golf course construction along Brasstown Creek may unfavorably alter its distribution.

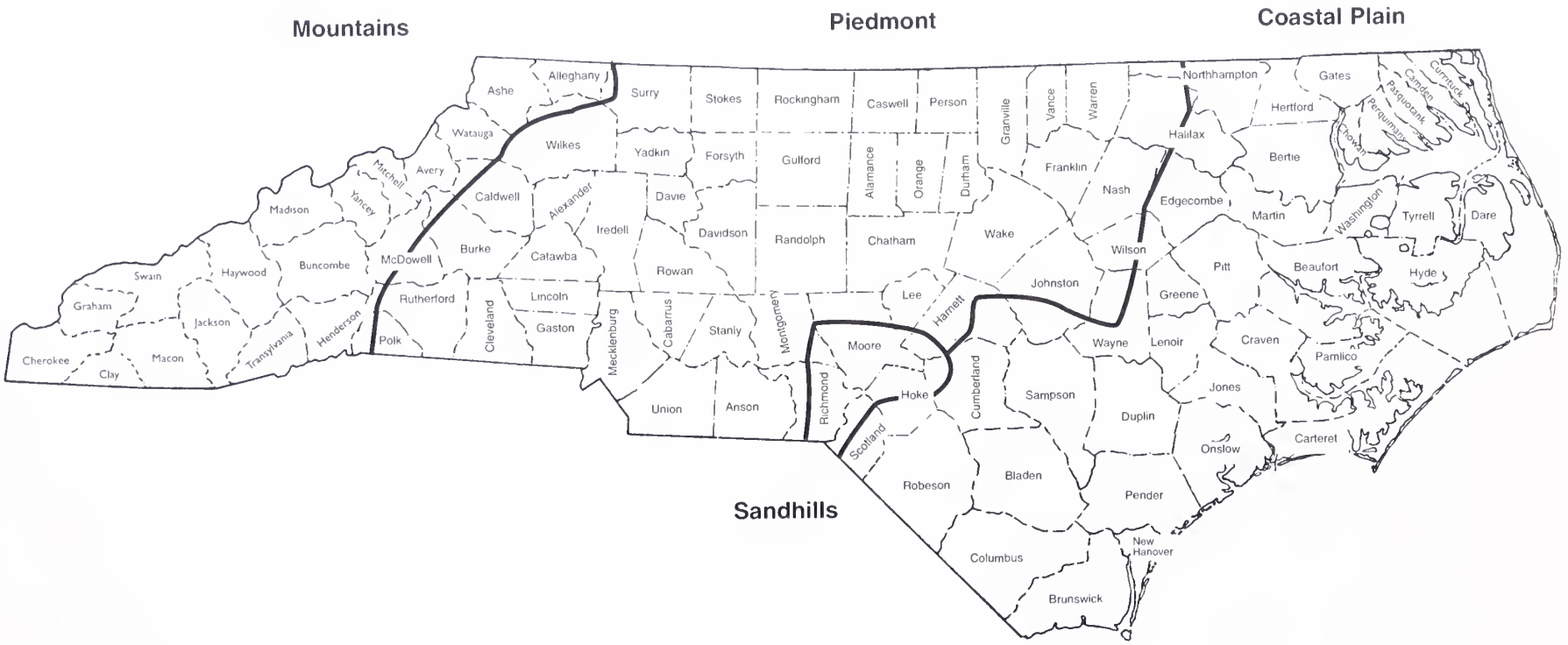
Current Protection. None.

Recommendations. The Blue Ridge streams in the Tennessee drainage should be searched for more populations. Studies should be undertaken to determine sites, habitat, and chronology of spawning, as well as other life history aspects.

LITERATURE CITED

Menhinick, E. F. 1991. The Freshwater Fishes of North Carolina. N.C. Wildl. Resour. Comm., Raleigh.

Prepared by Robert E. Jenkins and Byron J. Freeman



Map 1. Counties and Physiographic Provinces of North Carolina

Map 2. Major Drainage Systems of North Carolina

APPENDIX B

Table 1. Comparison of the State conservation status of North Carolina freshwater fishes between 1977 and 1991. Status in 1977 is from Cooper et al. (1977:265–298); 1991 status is from the N.C. Department of Wildlife Resources.*

Family/Species	Status in 1977	Status in 1991
PETROMYZONTIDAE		
Lampetra aepyptera, Least Brook Lamprey	Special Concern	Special Concern
Lampetra appendix, American Brook Lamprey	(not listed)	Threatened
ACIPENSERIDAE		
Acipenser brevirostrum, Shortnose Sturgeon	(not listed)	Endangered
Acipenser fulvescens, Lake Sturgeon	Extirpated?	Special Concern
Acipenser oxyrhynchus, Atlantic Sturgeon	Special Concern	Special Concern
POLYODONTIDAE		
Polyodon spathula, Paddlefish	Endangered	Endangered
HIODONTIDAE		
Hiodon tergisus, Mooneye	Endangered	Special Concern
ESOCIDAE		
Esox masquinongy, Muskellunge	Extirpated?	**
CYPRINIDAE		
Clinostomus funduloides ssp.,"Little Tennessee Rosyside Dace"	(not listed)	Special Concern
Cyprinella (=Hybopsis) monacha, Spotfin Chub	Endangered; Extirpated?	Threatened
Cyprinella (=Hybopsis) zanema, Santee Chub	Special Concern	(removed)
Cyprinella (=Hybopsis) zanema form, Thinlip Chub	Special Concern	Special Concern
Exoglossum laurae, Tonguetied Minnow	Special Concern	(removed)
Exoglossum maxillingua, Cutlips Minnow	Special Concern	Endangered
Hybopsis rubrifrons, Rosyface Chub	Special Concern	Threatened
Luxilus (=Notropis) chrysocephalus, Striped Shiner	(not listed)	Threatened
Nocomis leptocephalus interocularis, Bluehead Chub ssp.	Special Concern	(removed)
Nocomis platyrhynchus, Bigmouth Chub	Special Concern	(removed)
Notropis bifrenatus, Bridle Shiner	Endangered; Extirpated?	Special Concern
Notropis lutipinnis, Yellowfin Shiner	(not listed)	Special Concern
Notropis mekistocholas, Cape Fear Shiner	Special Concern	Endangered
Notropis rubellus, Rosyface Shiner	Special Concern	(removed)
Notropis scabriceps, New River Shiner	Special Concern	(removed)
Phenacobius teretulus, Kanawha Minnow	Threatened	Special Concern
Pimephales notatus, Bluntnose Minnow	Special Concern	(removed)
Semotilus lumbee, Sandhills Chub	Special Concern	Special Concern
CATOSTOMIDAE		
Carpiodes carpio, River Carpsucker	Special Concern	Special Concern
Carpiodes velifer, Highfin Carpsucker	(not listed)	Special Concern
Hypentelium roanokense, Roanoke Hog Sucker	Special Concern	(removed)
Scartomyzon ariommus (=Moxostoma ariommum), Bigeye Jumprock	Special Concern	Special Concern
Thoburnia (=Moxostoma) hamiltoni, Rustyside Sucker	(not listed)	Endangered
ICTALURIDAE		
Noturus eleutherus, Mountain Madtom	Extirpated	Special Concern
Noturus flavus, Stonecat	(not listed)	Endangered
Noturus furiosus, Carolina Madtom (Neuse drainage)	Special Concern	Special Concern
Noturus furiosus, Carolina Madtom (Tar drainage)	Special Concern	(removed)
Noturus gilberti, Orangefin Madtom	Threatened	Endangered
Noturus sp., Broadtail Madtom	Special Concern	Special Concern
CYPRINODONTIDAE		
Fundulus waccamensis, Waccamaw Killifish	Endangered	Special Concern
Lucania goodei, Bluefin Killifish	(not listed)	Special Concern

Table 1, continued

Family/Species	Status in 1977	Status in 1991
Poeciliidae		
Heterandria formosa, Least Killifish	(not listed)	Special Concern
Atherinidae		
Menidia extensa, Waccamaw Silverside	Endangered	Threatened
Centrarchidae		
Ambloplites cavifrons, Roanoke Bass	Special Concern	**
Micropterus coosae, Redeye Bass	Special Concern	**
Micropterus punctulatus, Spotted Bass	Special Concern	**
Elassomatidae		
Elassoma boehlkei, Carolina Pygmy Sunfish	(not listed)	Threatened
Percidae		
Etheostoma acuticeps, Sharphead Darter	Extirpated	Threatened
Etheostoma collis, Carolina Darter	Special Concern	Special Concern
Etheostoma inscriptum, Turquoise Darter	Special Concern	Special Concern
Etheostoma jessiae, Blueside Darter	Endangered	Special Concern
Etheostoma kanawhae, Kanawha Darter	Threatened	(removed)
Etheostoma mariae, Pinewoods Darter	Special Concern	Special Concern
Etheostoma perlongum, Waccamaw Darter	Endangered	Threatened
Etheostoma podostemone, Riverweed Darter	Special Concern	Special Concern
Etheostoma simoterum, Snubnose Darter	Extirpated	Special Concern
Etheostoma thalassinum, Seagreen Darter	Special Concern	(removed)
Etheostoma vulneratum, Wounded Darter	(not listed)	Special Concern
Percina aurantiaca, Tangerine Darter	Special Concern	(removed)
Percina burtoni, Blotchside Logperch	Endangered; Extirpated	Endangered
Percina caprodes, Logperch	Threatened	Threatened
Percina gymnocephala (=maculata), Blackside Darter	Special Concern	(removed)
Percina macrocephala, Longhead Darter	Endangered; Extirpated	Special Concern
Percina oxyrhynchus (=oxyrhynca), Sharpnose Darter	Special Concern	Special Concern
Percina sciera, Dusky Darter	Special Concern	Endangered
Percina squamata, Olive Darter	Threatened; Special Concern	Special Concern
Sciaenidae		
Aplodinotus grunniens, Freshwater Drum	(not listed)	Threatened
Cottidae		
Cottus carolinae, Banded Sculpin	(not listed)	Threatened

*In 1977 Special Concern status did not confer legal protection. With enactment of the state's nongame endangered wildlife law (1987), Endangered and Threatened status categories are now legally recognized, and species assigned Special Concern status are afforded legal protection.

**Game species are not eligible for protection under the N.C. nongame endangered wildlife law.

Table 2. Changes since the 1991 Freshwater Fishes Scientific Council report submitted to the N.C. Wildlife Resources Commission.

Nomenclature:

1991	1997
Hybopsis monacha	*Cyprinella monacha*
Hybopsis zanema	*Cyprinella zanema*
Hybopsis zanema form	*Cyprinella zanema* form
Moxostoma ariommum	*Scartomyzon ariommus*
Moxostoma hamiltoni	*Thoburnia hamiltoni*
Notropis chrysocephalus	*Luxilus chrysocephalus*
Percina maculata	*Percina gymnocephala*
Percina oxyrhyncha	*Percina oxyrhynchus*

Additional Species Considered:

Name	Proposed Status
Moxostoma robustum, "Robust Redhorse"	Federally Endangered
Moxostoma sp., "Sicklefin Redhorse"	Under evaluation

Species Accounts Replaced:

1991	1997
Moxostoma carinatum form, River Redhorse (record previously misidentified as *M. carinatum* form, now properly identified as *M. robustum*)	*Moxostoma robustum,* "Robust Redhorse"

Status Changes Recommended:

Name	Assigned Status	Recommended Status
Lampetra aepyptera, Least Brook Lamprey	Special Concern	State Threatened
Scartomyzon ariommus, Bigeye Jumprock	Special Concern	State Threatened

Table 3a. Distribution by drainage system of fish species with Federally Endangered (FE), State Endangered (SE), Federally Threatened (FT), State Threatened (ST), or Special Concern (SC) legal status. Lowercase symbols indicate extirpation from part or all of the drainage system; (?) indicates questionable record.

Species (Common Name)	Cape Fear			Catawba	Chowan	Minor Coastal Drainages	French Broad (including Pigeon and Toe)				Hiwassee
	Black/ South River	Lower CF	Upper CF				Cane River	Lower FB	Upper FB	Other	
American Brook Lamprey								ST			
Atlantic Sturgeon		SC				SC					
Banded Sculpin								ST/ st			
Bigeye Jumprock											
Blotchside Logperch							se		se	SE	
Bluefin Killifish		SC									
Blueside Darter									sc		
Bridle Shiner											
Broadtail Madtom	SC										
Cape Fear Shiner			FE/ fe								
Carolina Darter			SC	SC							
Carolina Madtom											
Carolina Pygmy Sunfish											
Cutlips Minnow											
Dusky Darter								SE			
Freshwater Drum								ST			
Highfin Carpsucker		SC		SC							(?)
Kanawha Minnow											
Lake Sturgeon								sc			
Least Brook Lamprey											
Least Killifish		SC									
"Little Tennessee Rosyside Dace"											
Logperch								ST			
Longhead Darter									sc		
Mooneye								SC	sc		
Mountain Madtom								sc			
Olive Darter							SC	SC		SC	SC
Orangefin Madtom											
Paddlefish								SE	se		
Pinewoods Darter											

Table 3a. Continued.

River Carpsucker								SC			
Riverweed Darter											
Rosyface Chub											
Rustyside Sucker											
Sandhills Chub			SC								
Sharphead Darter							ST			st	
Sharpnose Darter											
Shortnose Sturgeon		FE			fe						
Snubnose Darter								sc			
Spotfin Chub								ft	ft		
Stonecat							SE	SE			
Striped Shiner							ST				
Thinlip Chub	SC		SC								
Turquoise Darter											
Waccamaw Darter											
Waccamaw Killfish						SC*					
Waccamaw Silverside											
Wounded Darter								sc			
Yellowfin Shiner											

*In Phelps Lake.

Table 3b. Distribution by drainage system of fish species with Federally Endangered (FE), State Endangered (SE), Federally Threatened (FT), State Threatened (ST), or Special Concern (SC) legal status. Lowercase symbols indicate extirpation from part or all of the drainage system.

Species (Common Name)	Little Tennessee	Lumber		Neuse	New	Roanoke/Dan	Savannah	Tar	Yadkin/Pee Dee
		Lake Waccamaw	Lumber River						
American Brook Lamprey									
Atlantic Sturgeon									SC
Banded Sculpin									
Bigeye Jumprock						SE			
Blotchside Logperch									
Bluefin Killifish									
Blueside Darter									
Bridle Shiner				sc*					
Broadtail Madtom		SC	SC						
Cape Fear Shiner									
Carolina Darter				SC		SC		SC	SC
Carolina Madtom				SC				**	
Carolina Pygmy Sunfish		ST							
Cutlips Minnow						SE			
Dusky Darter									
Freshwater Drum									
Highfin Carpsucker									SC
Kanawha Minnow					SC				
Lake Sturgeon									
Least Brook Lamprey				SC				SC	
Least Killifish									
"Little Tennessee Rosyside Dace"	SC								
Logperch					ST				
Longhead Darter									
Mooneye									
Mountain Madtom									
Olive Darter	SC								
Orangefin Madtom						SE			
Paddlefish									
Pinewoods Darter			SC						

Table 3b. Continued.

River Carpsucker									
Riverweed Darter						SC			
Rosyface Chub							ST		
Rustyside Sucker						SE			
Sandhills Chub			SC						SC
Sharphead Darter									
Sharpnose Darter					SC				
Shortnose Sturgeon									FE
Snubnose Darter									
Spotfin Chub	FT / ft								
Stonecat	SE								
Striped Shiner									
Thinlip Chub			SC						SC
Turquoise Darter							SC		
Waccamaw Darter		ST							
Waccamaw Killifish		SC							
Waccamaw Silverside		FT							
Wounded Darter	SC								
Yellowfin Shiner	SC						SC		

*Most likely extirpated.
**Removed from Special Concern status in this drainage.

APPENDIX C

Protected Species and the North Carolina Counties They Inhabit

American Brook Lamprey
Madison

Atlantic Sturgeon
Beaufort
Bertie
Bladen
Brunswick
Camden
Carteret
Chowan
Craven
Currituck
Dare
Hyde
Martin
New Hanover
Onslow
Pamlico
Pasquotank
Richmond
Tyrell
Washington

Banded Sculpin
Madison
(extirpated at some locations)

Bigeye Jumprock
Rockingham
Stokes

Blotchside Logperch
Buncombe (extirpated)
Yancey
(extirpated at one location)

Bluefin Killifish
New Hanover

Blueside Darter
Henderson (extirpated)

Bridle Shiner
Craven (extirpated?)

Broadtail Madtom
Bladen
Brunswick
Columbus
Robeson
Sampson

Cape Fear Shiner
Chatham
(extirpated in some locations)
Harnett (extirpated)
Lee
Moore
Randolph

Carolina Darter
Alamance
Anson
Cabarrus
Davidson
Durham
Granville
Guilford
Mecklenburg
Montgomery
Moore
Orange
Person
Randolph
Richmond
Stanley
Union
Wake

Carolina Madtom
Craven
Durham
Edgecombe
Franklin
Greene
Halifax
Johnston
Jones
Lenoir
Nash
Vance
Wake
Wilson

Carolina Pygmy Sunfish
Brunswick
Columbus

Cutlips Minnow
Stokes

Dusky Darter
Madison

Freshwater Drum
Madison

Highfin Carpsucker
Anson
Bladen
Catawba
Cherokee (questionable record)
Gaston
Lincoln
Mecklenburg
Richmond

Kanawha Minnow
Alleghany
Ashe
Watauga

Lake Sturgeon
Madison (extirpated)

Least Brook Lamprey
Edgecombe
Halifax
Johnston
Pitt
Wake
Warren

Least Killifish
Brunswick
New Hanover

"Little Tennessee Rosyside Dace"
Graham
Jackson
Macon
Swain

Logperch
Alleghany
Madison

Longhead Darter
Buncombe (extirpated)

Mooneye
Henderson (extirpated)
Madison

Mountain Madtom
Madison (extirpated)

Olive Darter
- Cherokee
- Jackson
- Madison
- Mason
- Mitchell
- Swain
- Yancey

Orangefin Madtom
- Stokes

Paddlefish
- Buncombe (extirpated)
- Madison

Pinewoods Darter
- Hoke
- Montgomery
- Moore
- Richmond
- Robeson
- Scotland

River Carpsucker
- Madison

Riverweed Darter
- Rockingham
- Stokes

Rosyface Chub
- Transylvania

Rustyside Sucker
- Stokes

Sandhills Chub
- Hoke
- Moore
- Richmond
- Scotland

Sharphead Darter
- Mitchell (extirpated in one location)
- Yancey

Sharpnose Darter
- Alleghany
- Ashe

Shortnose Sturgeon
- Bertie (extirpated)
- Bladen
- Brunswick
- New Hanover
- Richmond

Snubnose Darter
- Madison (extirpated)

Spotfin Chub
- Buncombe (extirpated)
- Macon
- Madison (extirpated)
- Swain

Stonecat
- Buncombe
- Madison
- Swain
- Yancey

Striped Shiner
- Yancey

Thinlip Chub
- Anson
- Bladen
- Cumberland
- Harnett
- Hoke
- Robeson
- Sampson
- Scotland

Turquoise Darter
- Transylvania

Waccamaw Darter
- Columbus

Waccamaw Killifish
- Columbus
- Washington

Waccamaw Silverside
- Columbus

Wounded Darter
- Jackson
- Macon
- Madison (extirpated)
- Swain

Yellowfin Shiner
- Jackson
- Transylvania

APPENDIX D

North Carolina Counties and the Protected Species They Contain

Alamance
- Carolina Darter

Alleghany
- Kanawha Minnow
- Logperch
- Sharpnose Darter

Anson
- Carolina Darter
- Highfin Carpsucker
- Thinlip Chub

Ashe
- Kanawha Minnow
- Sharpnose Darter

Beaufort
- Atlantic Sturgeon

Bertie
- Atlantic Sturgeon
- Shortnose Sturgeon (extirpated)

Bladen
- Atlantic Sturgeon
- Broadtail Madtom
- Highfin Carpsucker
- Shortnose Sturgeon
- Thinlip Chub

Brunswick
- Atlantic Sturgeon
- Broadtail Madtom
- Carolina Pygmy Sunfish
- Least Killifish
- Shortnose Sturgeon

Buncombe
- Blotchside Logperch (extirpated)
- Longhead Darter (extirpated)
- Paddlefish (extirpated)
- Spotfin Chub (extirpated)
- Stonecat

Cabarrus
- Carolina Darter

Camden
- Atlantic Sturgeon

Carteret
- Atlantic Sturgeon

Catawba
- Highfin Carpsucker

Chatham
- Cape Fear Shiner (extirpated in some locations)

Cherokee
- Highfin Carpsucker (questionable record)
- Olive Darter

Chowan
- Atlantic Sturgeon

Columbus
- Broadtail Madtom
- Carolina Pygmy Sunfish
- Waccamaw Darter
- Waccamaw Killifish
- Waccamaw Silverside

Craven
- Atlantic Sturgeon
- Bridle Shiner (extirpated?)
- Carolina Madtom

Cumberland
- Thinlip Chub

Currituck
- Atlantic Sturgeon

Dare
- Atlantic Sturgeon

Davidson
- Carolina Darter

Durham
- Carolina Darter
- Carolina Madtom

Edgecombe
- Carolina Madtom
- Least Brook Lamprey

Franklin
- Carolina Madtom

Gaston
- Highfin Carpsucker

Graham
- "Little Tennessee Rosyside Dace"

Granville
- Carolina Darter

Greene
- Carolina Madtom

Guilford
- Carolina Darter

Halifax
- Carolina Madtom
- Least Brook Lamprey

Harnett
- Cape Fear Shiner (extirpated)
- Thinlip Chub

Henderson
- Blueside Darter (extirpated)
- Mooneye (extirpated)

Hoke
- Pinewoods Darter
- Sandhills Chub
- Thinlip Chub

Hyde
- Atlantic Sturgeon

Jackson
- Little Tennessee Rosyside Dace
- Olive Darter
- Wounded Darter
- Yellowfin Shiner

Johnston
- Carolina Madtom
- Least Brook Lamprey

Jones
- Carolina Madtom
- Least Brook Lamprey

Lee
- Cape Fear Shiner

Lenoir
- Carolina Madtom

Lincoln
- Highfin Carpsucker

Macon
- Little Tennessee Rosyside Dace
- Olive Darter
- Spotfin Chub
- Wounded Darter

Madison
- American Brook Lamprey
- Banded Sculpin (extirpated at some locations)
- Dusky Darter
- Freshwater Drum
- Lake Sturgeon (extirpated)
- Logperch
- Mooneye
- Mountain Madtom (extirpated)
- Olive Darter
- Paddlefish
- River Carpsucker
- Snubnose Darter (extirpated)
- Spotfin Chub (extirpated)
- Stonecat
- Wounded Darter (extirpated)

Martin
- Atlantic Sturgeon

Mecklenburg
- Carolina Darter
- Highfin Carpsucker

Mitchell
- Olive Darter
- Sharphead Darter (extirpated in one location)

Montgomery
- Carolina Darter
- Pinewoods Darter

Moore
- Cape Fear Shiner
- Carolina Darter
- Pinewoods Darter
- Sandhills Chub

Nash
- Carolina Madtom

New Hanover
- Atlantic Sturgeon
- Bluefin Killifish
- Least Killifish
- Shortnose Sturgeon

Onslow
- Atlantic Sturgeon

Orange
- Carolina Darter

Pamlico
- Atlantic Sturgeon

Pasquotank
- Atlantic Sturgeon

Person
- Carolina Darter

Pitt
- Least Brook Lamprey

Randolph
- Cape Fear Shiner
- Carolina Darter

Richmond
- Atlantic Sturgeon
- Carolina Darter
- Highfin Carpsucker
- Pinewoods Darter
- Sandhills Chub
- Shortnose Sturgeon

Robeson
- Broadtail Madtom
- Pinewoods Darter
- Thinlip Chub

Rockingham
- Bigeye Jumprock
- Riverweed Darter

Sampson
- Broadtail Madtom
- Thinlip Chub

Scotland
- Pinewoods Darter
- Sandhills Chub
- Thinlip Chub

Stanley
- Carolina Darter

Stokes
- Bigeye Jumprock
- Cutlips Minnow
- Orangefin Madtom
- Riverweed Darter
- Rustyside Sucker

Swain
- "Little Tennessee Rosyside Dace"
- Olive Darter
- Spotfin Chub
- Stonecat
- Wounded Darter

Transylvania
- Rosyface Chub
- Turquoise Darter
- Yellowfin Shiner

Tyrell
- Atlantic Sturgeon

Union
- Carolina Darter

Vance
- Carolina Madtom

Wake
- Carolina Darter
- Carolina Madtom
- Least Brook Lamprey

Warren
- Least Brook Lamprey

Washington
- Atlantic Sturgeon
- Waccamaw Killifish

Watauga
- Kanawha Minnow

Wilson
- Carolina Madtom

Yancey
- Blotchside Logperch (extirpated at one location)
- Olive Darter
- Sharphead Darter
- Stonecat
- Striped Shiner

INDEX TO COMMON AND SCIENTIFIC NAMES

Text **Illustration** *Map*

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O

P

R

S

T

V

W

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Z

* Species is mentioned only in Table 1, where it is noted for its removal from special status as of 1991.

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